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Annual Progress and Statistical Issue

Electrical World

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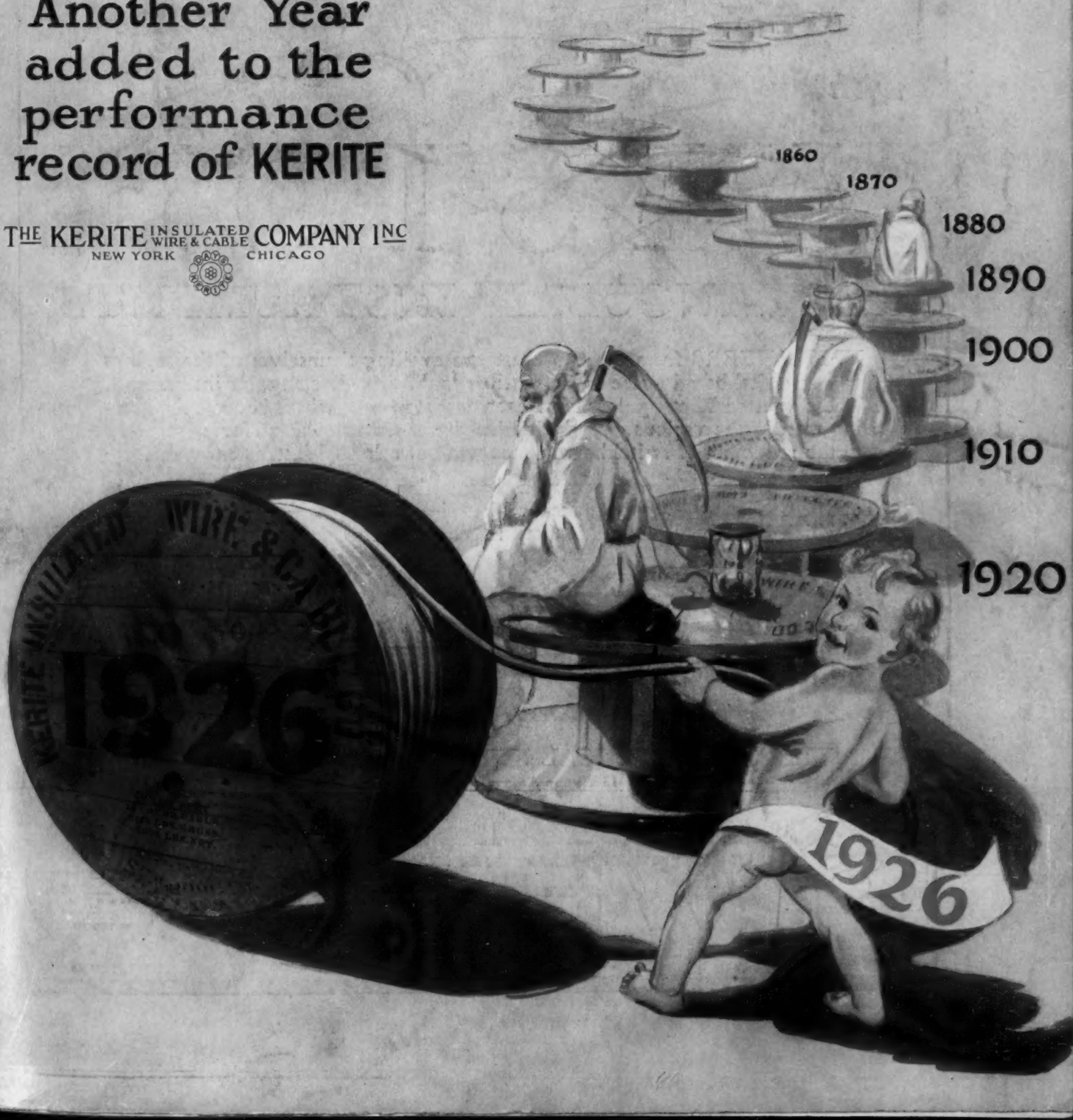

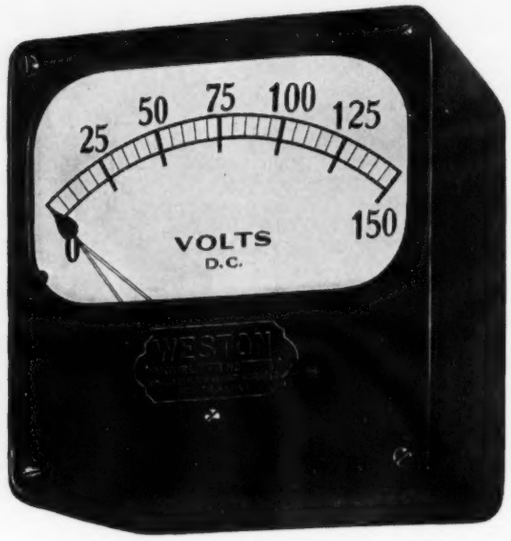

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Electrical World

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W. H. ONKEN, JR.
Editor

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Half Way in a Stupendous Task

CLEARLY apparent is the prosperity of the United States. There is therefore no reason why the year 1926 should not make good its promise of still greater growth and expansion in the electrical industry, whose wellbeing is closely entwined with that of the nation itself and to a greater degree than most other industries. This is indicated to some extent by the fact that the new capital issues distributed in the United States in 1925 exceeded $6,000,000,000 and of that prodigious sum approximately one-quarter was absorbed by the electrical industry. It seems altogether probable that the financial requirements of the industry will, for the next few years at least, continue to increase in both size and importance. Millions of Americans not ordinarily investors have through the instrumentality of electric light and power companies become persuaded of the value of thrift and particularly of the desirability and stability of the securities of electric public utilities, so that wage earners of every type now invest their savings in such securities. One has but to scan any securities investment list to determine how highly the electric light and power industry is also regarded by the investing public. This means much to the industry and to its continued expansion. In turn the amplified facilities thus afforded are bound to affect beneficially American industries and American homes and to augment production and living standards. Thus our national wealth will continue to be distributed more widely than in any other nation, and national happiness, so far as that can be founded on a material basis, will, in the comfort of the present and the security of the future, be still further increased. Better than any other triumph of electricity is its universality.

THE electric communication companies have not shared in the general prosperity to the same extent as the electric light and power companies. Although the American Telephone & Telegraph Company and its subsidiary Bell companies will be busy for years in changing over from manual to machine switching operation, a change-over which will involve great capital expenditure and tax telephone manufacturing facilities, the consequent effect of the expenditure on rate structures will without doubt impair the percentage rate increase in telephone traffic. Telegraphy has not for some years promised to expand much, and wireless seems to have caught up with itself. Great improvement is possible in wireless receiving sets, however, and also in the type of program broadcasted. The time cannot be far off when in communities enjoying electric service the "A," "B" and "C" batteries can be entirely dispensed with and the receiving set plugged in on the lighting circuit, much to the benefit of the art and the satisfaction of the user. With this change should come renewed interest and activity in radio.

PROSPERITY in the other branches of the electrical industry—manufacturing, jobbing and contracting—is more or less dependent on that of the power companies, and inasmuch as the latter have enjoyed and will still enjoy great prosperity the future need hold no fear for the manufacturers and distributors. Even the electric railways see the dawn of a new era. This does not necessarily foretell an expansion of manufacturing and distributing facilities. The industry is sufficiently equipped now to take care of its growth, and if it surveys the situation calmly and sanely, will employ the means which it now possesses to maximum advantage. The trend is toward consolidation of properties and co-ordination of facilities. Larger and more economical stations will result, with more "tie-ins" and increased exchange of energy to keep down investment. It is in the utilization of the electricity generated, however, that most activity will center. Labor-saving devices, already in large demand, will find still greater and wider application. Domestic electric refrigeration, for example, has become so popular that the demand for it far exceeds the supply of dependable devices. Labor also is becoming so costly that greater use must be made of machinery.

WHILE the electrical industry has enjoyed an unprecedented growth and has reason to be proud of its accomplishments, it is important that its foundations be kept firm and strong and that bigness shall not distort its vision. Size at most is but relative. The less the industry concerns itself about its size and the more it applies itself to service, the greater it will become. Bigness in its best and truest sense is not measured in billions of kilowatt-hours or in millions of kilowatts of generating equipment. It consists in growing multitudes of customers served and satisfied. Bigness of plant may in itself evoke distrust and opposition. Mere size and power will not command the respect of a democratic people. Bigness of mind and heart will. The electrical industry, which cherishes the ideal of some day lightening the chores of the poorest housewife and carrying help to the remotest farmer, will until that still far-off period lose little time in boasting. It is too intent on its colossal and only half-finished task. If it seems to view with complacence its past accomplishments, it is because the things which have been done are tangible evidence of the possibility of the things which the industry has in view.

A Time for Retrospection

HARDLY a convention or meeting of utility men was held in the past year in which the subject of public relations was not made a major topic of discussion. Out of these discussions have come many suggestions that have made the listeners recognize the importance of good will and the necessity of concerted effort to get it and to keep it. From all outward signs nearly every attendant at such gatherings has gone home with the sincere intention of applying in his work the principles enunciated or implied. Many have actually carried out their good intentions to a greater or less degree; but, through loss of inspiration, pressure of work, lack of complete knowledge regarding the causes of public irritation and various other reasons, others have done little or nothing to translate good resolutions into good achievements.

Considering the number of existing electric service companies, the immeasurably greater number of individuals involved and the complexity of the public relations problems, remarkable progress has been made in building up good will. But should a single individual rest on laurels won and become a passive onlooker, feeling that sufficient good work will henceforth be done by others? Furthermore, is it not time for every company to "take stock" of the relative effectiveness of its methods by ascertaining, directly or indirectly, the attitude of its customers toward the company and the causes of irritation, if any exist, rather than to assume that everything is roseate? Observations have led to a belief that some utility companies are going to unnecessary expense in carrying out certain public relations measures which do not have so much effect on good will as other less costly practices which are possibly overlooked. Some of these practices are considered in the interview with R. F. Pack, vice-president and general manager of the Northern States Power Company, published in this issue. They will be found suggestive of yet other methods that carry the promise of effectiveness.

Engineers Seek Perfection and Economy

ENGINEERING developments during the past year have been rapid. In lighting, in communication, in power applications and in machine design there have been notable advances. Higher efficiency, better performance and the production of new types of equipment have been outstanding features of the progress. But the greatest change in engineering has come about through the trend toward large consolidations in all lines of industry in order to gain economies in operation and management.

Engineers have become organizers of large groups of engineering apparatus whose assembled objective is definitely specified. In the industrial plant the engineer must select, install and operate his equipment to secure maximum reliability and economy in production. In the light and power industry he again encounters a vast assembly of equipment whose use is to get continuous electric service at a minimum cost. The same conditions exist in the large communication systems.

Naturally these developments call for a kind of organization and thinking that differs from the older engineering practice, where there was concentration on one element or on a few elements only. The new engineering calls for team play and human organization because the tasks at hand are too big to be attacked haphazardly by individual workers. Engineers now have to deal with plants on a scale far larger than formerly and have been forced to develop an economic sense and a knowledge of relative values in order to do their work.

The Central Station's Place in Appliance Selling

ELECTRIC power and light companies cannot yet and perhaps may never be able to depend upon other electrical and non-electrical dealers to build up and maintain a satisfactory volume of electrical appliance sales. This condition and the growing importance which the central-station industry attaches to this business as a means of building up its residential customers' energy consumption may be traced in the results of the ELECTRICAL WORLD'S national survey, just completed and published in this issue. Total appliance sales by the 2,644 companies actively engaged in merchandising amounted to more than $57,000,000 in 1925—an increase in the five-year period since 1920 of 170 per cent. The steps in this increase bear witness to an interesting and significant transition in central-station merchandising policy.

Sales in 1921 were only 5.7 per cent more than those of 1920, but in 1922 and 1923 they were 52.2 and 47.8 per cent respectively over the year just previous, and in 1924 and 1925 the increases were 17.5 and 21 per cent. In these percentages may be seen the effect in 1920 and 1921 of the power companies' experiment in trying to pass the appliance business on to the other hands and then in 1922 their recognition of the impracticability of that theory.

Further analysis of the data collected shows that in the territories where the power companies merchandise —and this practice is followed by utilities serving 60.1 per cent of the 14,538,000 residential customers in the country—central-station appliance sales represent 42.5 per cent of the total sales by all dealers. The remaining 57.5 per cent is divided as follows: Other electrical dealers, 26.9 per cent; department stores, 15.4 per cent; other miscellaneous stores, 15.2 per cent. From this it is apparent that, taken the country over, the electric utilities are by long odds the chief retail outlet for electric household devices, and, judging from the extensive sales organizations they are building up, their preparations and facilities for handling deferred-payment sales, their service and repair policies and their need for more business from domestic customers, they will continue to be the leading electrical merchandisers.

If other dealers, both electrical and non-electrical, could or would build up their sales volume so as to reduce the power companies' proportionately large share of the total, it would aid materially in a quicker and more complete electrification of the home. But, desirable as such a condition may be from the utility's viewpoint and great as has been the effort to bring this about, the prime responsibility for pioneering new devices, for insuring repair service and for the maintenance of a fair standard in sales policy and quality of merchandise will still rest with the central station.

A Glance at the Old Calendar and the New

NEWS has no past tense, for history is not news. News has a future tense, however, for plans and proposals are news, and note of them must lead up to the present tense of accomplishment. The electrical industry was big with such news in 1925. Muscle Shoals, talked of almost to weariness, is, despite the throbbing generators at Wilson Dam, still future news —its ultimate destiny helping to encumber the knees of the gods. Colorado River development is future news, Arizona still hesitating to join hands with the six sister states in the basin. Conowingo, after a year of argument and delay, is future news, the equilateral triangle of its regulation still unconstructed. St. Lawrence power is future news, with John Canuck and Brother Jonathan sparring warily for position. Here are four vast projects which some day will be facts. But they move slowly over roads strewn with obstacles and with rival chauffeurs disputing the right to steer them through political fog. The new year before it becomes the old will probably witness the beginning of a dam at Conowingo; it may see a Muscle Shoals policy adopted by Congress and approved by President Coolidge, but that is doubtful; it will almost certainly fail to see anything accomplished on the Colorado, save possibly at Diamond Creek, and it will continue in all probability to observe the St. Lawrence flow down to the sea unvexed by even the first rough timbers for canals and dams.

Such great projects must needs move slowly because of their interstate and international character and the part played in them by the people's representatives in executive and legislative office. But there are other great projects, happily under single and private control, which, once approved by the state, go ahead with swift and steady precision to their goal. Thus a single year sees a vast steam-electric generating plant brought to partial completion on the meadows of New Jersey, to serve the metropolitan district of that state; another come into commission in Chicago, a third in Philadelphia, and construction begun on a fourth in New York City. In a score of other places in the East and Middle West plants subordinate in size only to those just mentioned are completed or begun. On the Pacific Coast Big Creek and Pit River add plant to plant, harness for other great water-power sites is made ready, and the Florence Lake Tunnel is driven through. In the South every muscle in the articulated electric system is willingly strained to meet an unprecedented drought, and, in the determination that a shortage of power shall never occur again, storage facilities are increased and a steam plant of large dimensions is planned over night for immediate construction in the district where it is needed most. In Quebec international capital develops the mighty Saguenay. In every part of the continent transmission systems spring up and expand, with scant regard for state boundaries, until the traveler by rail or on the highways has to go far and into districts remote from industrial centers to lose sight of the steel and wooden poles that support the electrical web.

The contrast thus afforded between business enterprise unhampered save by the police power of the state fairly and intelligently applied and business enterprise waiting on laws and lawmakers is a significant one. Fortunately no important legislation inimical to any properly conducted utility company was passed in any state in 1925. The advocates of public ownership, whose schemes met with defeat in 1924 in California, Washington and Montana, were entitled to a breathing spell and apparently were glad to take it. Governor Pinchot of Pennsylvania, to be sure, saw things at night and summoned the good Giant Power to overthrow the wicked ogre Superpower. Sooner or later belief in both the ogre and the giant will fade from the public mind, which will grasp instead the idea of a beneficent but perfectly human and controllable worker with the unpretentious, mattér-of-fact name of Interconnection—a worker that will hasten the full advent of the electrical age, but will neither bring Utopia in a year nor enslave the American people while they are not looking.

A more genuine and widespread public interest—one shared by every housewife in a wired home—attaches to reductions in domestic rates. The year 1925 saw these take effect in some of the largest and in scores of the smaller cities of the land. Such public interest attaches, too, to the extension of farm service, now a matter of investigation in half the commonwealths. It attaches to the sale to customers of public utility securities, and to the existence in a community of a brilliant street-lighting system, an ultra-modern power house or the largest or highest or longest something or other in the state, the country or the world. Low rates, efficient service and courteous dealings—here is the trinity of popularity. Where all three prevail few indeed want to elect the utility manager at the polls or have political agents control his managerial actions. Where one new municipal plant was set up last year a dozen or more went on the lines of a central-station company. It is useless to fight against the trend of advancing civilization. A few large city plants, long well established and sometimes well run, may still endure for years to come. These no one wishes to destroy, but the small town or the hamlet within reach of a transmission line is as ill advised when it continues to make its own electric power as would be the citizen who should make his own shoes. This clear lesson, emphasized in 1925, the new year is likely to make clearer yet.

"Pale Death, knocking with impartial foot," summoned last year from the ranks of light and power company executives three outstanding figures in James B. Duke, the upbuilder of the Carolinas; John I. Beggs, who had directed properties in Milwaukee, Cincinnati and St. Louis, and Milan R. Bump, engineer, manager and quite recently head of the National Electric Light Association. In England died Oliver Heaviside, the recluse whose technical genius no bushel measure could hide, and in Canada Adam Beck, creator of the greatest governmental lighting and power system that has yet appeared. These and other losses of 1925 and previous years are heavy ones, but yet the electrical industry in America has reason for gratitude that so many of those who were in at its birth are still actively leading its ranks. Headed by the Veteran of Menlo Park, with whom most of these pioneers served in the far-away eighties, their vigor and their modernity are an inspiration to younger men. Long may they live!

ELECTRICAL WORLD
extends to its readers the
season's greetings and
wishes them all a
happy and prosperous
New Year

In 1913 the average price of electricity for lighting purposes was 8.7 cents per kilowatt-hour; in 1925 the price was 7.5 cents. The price of almost everything else used by the public has increased greatly during the same period. Utility executives have introduced great economies in the production and distribution of electricity, and, of these economies, the public has received the benefit. This fact, emphasized in 1925, is likely to be made more evident still in 1926.

There are, as the old year ends, 6,000 light and power systems in this country, and they serve 17,937,160 customers. Investors have spent $6,344,000,000 for plant and equipment to give this service. This money is invested in 4,800 generating stations, with an aggregate rating of 26,830,000 kva. in generating capacity; in 109,170 circuit miles of high-tension transmission lines, in 451,990 circuit miles of distribution lines, and in buildings, substations and other physical plant. Next year these utilities expect to spend $734,350,000 for new plants, lines and miscellaneous purposes in order to keep pace with the demand of the public for electric service.

Each residential lighting customer pays about $2.50 a month for lighting service. This is less than the average family pays for picture shows, for newspapers, for telephone service, for candy, for cosmetics and many other items in the domestic budget. There are great possibilities ahead for increasing electric service in the home, while keeping the monthly bill an insignificant item of expense, and 1926 will bring about their partial realization.

The public continues to demand electric service in increased quality and quantity, and the utility companies continue to establish new records in their attempt to meet the demands. An output of nearly sixty billion kilowatt-hours of energy in 1925 and a revenue of a billion and a half dollars placed the light and power companies on a very high industrial plane as compared with any other industry in the nation.

Interconnections and the pooling of transmission, generation and distribution resources wrought powerfully last year to bring economic conceptions to practical realization. A total of 560 utility companies were involved in mergers, and the capitalization of the companies absorbed totaled almost two billion dollars. The same movement will persist in 1926. It is part and parcel of American progress and prosperity.

Record construction activities of the light and power industry during 1926 are clearly pictured in the construction budgets for the year. A total of $683,890,000 will be spent for added electrical equipment, generation and transmission, and in addition $50,460,000 will be spent for miscellaneous purposes—a total of almost $750,000,000. This means that a total of more than $2,000,000,000 will have been spent during 1924, 1925 and 1926 for expansion purposes.

There are still 8,157 private industrial generating plants in the nation, with an annual production of almost twelve billion kilowatt-hours. This in itself would provide a field of enviable potentialities for any industry of the first rank. But in addition 35 per cent of the industrial power of the country is not yet electrified either from central-station or private plants. The central-station industrial field as it exists today is only 37 per cent developed, and the industrial electric heating field has only been scratched.

Interest in power-factor correction reached a peak value during the year just past. Manufacturers of corrective equipment of many types and producers and users of electricity discussed the subject freely and fully. Practical applications of corrective devices were made in unprecedented numbers. Many utilities introduced rate clauses to encourage better power factor, and the whole industry gained a new conception of the practical and economic importance of this matter.

Greatly augmented interest in the merchandising of electrical appliances has marked the commercial activities of the power companies, and from the total sale throughout the country of $200,000,000 of household devices the utilities will in 1926 realize about $25,000,000 in increased energy sales. The popularity of the domestic refrigerator will have an extremely helpful effect in this direction. Approximately 80,000 of these machines were sold in 1925, and present indications are that nearly three times that number will be marketed in the coming twelvemonth.

During the last year commercial efforts were concentrated on building desirable new loads. As a result the new-business programs of the electric utilities were so shaped that industrial power, heating, domestic and commercial customers were cultivated to a degree never before deemed possible. Power companies serving industrial territories have made exhaustive surveys of existing and prospective customers' requirements and are concentrating their efforts on selective load development with the least waste of effort. It has become evident that the power sales engineer must become more of an industrial specialist.

Another milepost was passed by the electrical industry in 1925. For the first time since the war period the number of customers added during the year was under the number for the year previous. Almost 55 per cent of the population of the nation is now living in electrically lighted dwellings, although only 51.4 per cent of the population is classed by the Census Bureau as urban, and 65 per cent of the industrial power is electrified. Increased consumption per customer has taken the place of increased number of customers as the immediate aim of the industry.

Foundations for New Achievements

Public relations are good and the political horizon is clear.

Investors favor utility securities and ample money is available at reasonable rates.

Saturation in electrical sales or uses has not been approached.

Major economies in power production and distribution are in sight.

Valid predictions indicate a 15 per cent increase in business for next year.

Research workers continue to make new electrical knowledge available to engineers.

The spirit of service and co-operation permeates the electrical industry.

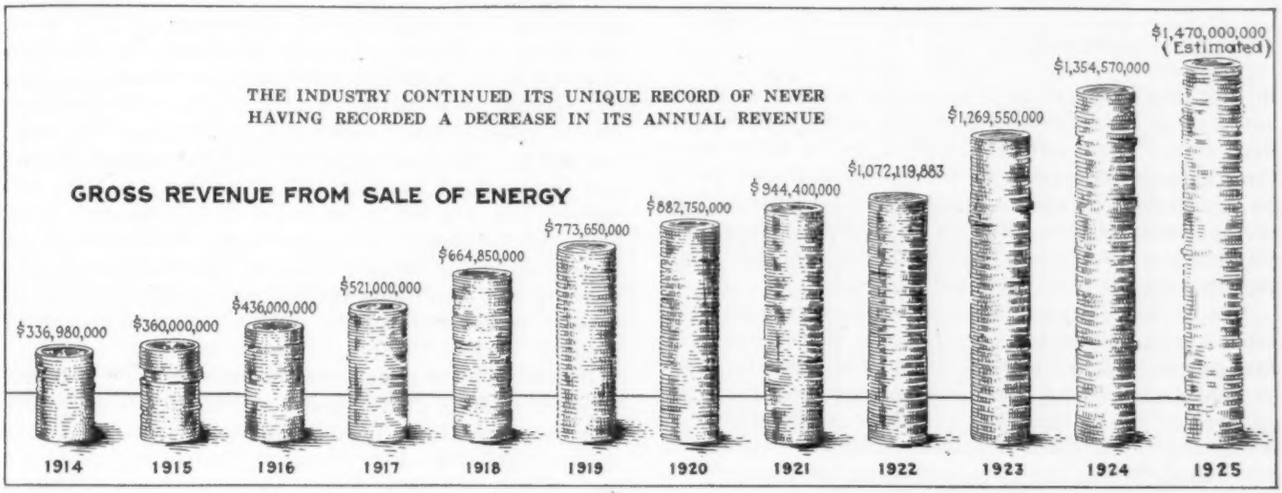
Railroads are ready for major electrifications.

Interconnections and consolidations promise economies in financing and skill in management.

Electricity is relatively still the cheapest and most useful agent known to mankind.

1925 a Record Year

Energy Generated During the Year Totaled 59,517,000,000 Kw.-Hr.—The Gross Revenue Is Estimated at $1,470,000,000—Several Distinct Trends Were Established During the Year



IT IS a mark of real distinction and achievement for an institution or a group of institutions to record the fact year after year that greater progress has been made in its operations than ever before. That group of public servants known as the electric light and power industry has again attained to new heights of achievement. Already a leader among the nation's industries, it progressed during 1925 as no other industry in the country. Its output of electrical energy has been increased by more than five billion kilowatt-hours, its gross revenue by more than a hundred and fifteen million dollars, its capitalization by approximately nine hundred million dollars, and its number of customers by over a million and a quarter.

The close of the year finds 17,937,160 customers of all kinds; approximately 63,100,000 persons living in electric-lighted dwellings; approximately 65 per cent of the industrial power of the nation electrified, two-thirds of the energy being supplied by central-station lines; approximately 1,300,000 customers holding stock in their local companies; and a total capital investment by the industry of $7,500,000,000. The energy generated during the year by the central-station plants totaled 59,517,000,000 kw.-hr., the gross revenue $1,470,000,000, and the operating expenses $659,000,000. The end of 1925 found a total generator rating of 26,830,000 kva. and a total of 194,000 central-station employees. An estimated total of 35,488,800 tons of coal were consumed by the power plants during the year as well as 9,869,000 barrels of crude oil and 47,313,400,000 cubic feet of natural gas. From a mere infant before the war the industry has progressed to a position in the economic and social world which few other industries can ever hope to attain.

The past year has been very largely but a continuation of the progress which the industry has experienced since the close of the war. Every section of the country has reported operations very close to the expected normal for the year, this normal being based upon the operations of the industry in the various sections during the past five years. The South Central States, however, reported operations far above the expected, the operations

Table I—Distribution of Central-Station Energy, 1913 to 1925

(100 per cent of the industry)

Year	Total Energy Generated, Kw.-Hr.†	Estimated Net Consumption by Customers (Kw.-Hr.)				Line Losses and Intra-Company Business, Kw.-Hr.
		Total	Lighting	Power	Railways	
1913	13,000,000,000	10,500,000,000	2,800,000,000	4,400,000,000	3,300,000,000	2,500,000,000
1914	14,400,000,000	11,620,000,000	2,900,000,000	5,370,000,000	3,350,000,000	2,780,000,000
1915	16,175,000,000	13,055,000,000	3,000,000,000	6,055,000,000	4,000,000,000	3,120,000,000
1916	21,230,000,000	17,130,000,000	3,580,000,000	9,450,000,000	4,100,000,000	4,100,000,000
1917	25,438,000,000	20,528,000,000	4,250,000,000	11,878,000,000	4,400,000,000	4,910,000,000
1918	29,200,000,000	23,570,000,000	5,200,000,000	13,870,000,000	4,500,000,000	5,630,000,000
1919	34,900,000,000	28,160,000,000	6,250,000,000	17,310,000,000	4,600,000,000	6,740,000,000
1920	39,518,903,000	31,898,903,000	7,580,000,000	19,498,903,000	4,820,000,000	7,620,000,000
1921	36,970,697,000	29,830,697,000	8,500,000,000	16,730,697,000	4,600,000,000	7,140,000,000
1922	43,559,677,000	35,159,677,000	9,298,000,000	20,219,677,000	5,642,000,000	8,400,000,000
1923	51,132,883,000	41,490,535,000	11,200,000,000	24,290,535,000	6,000,000,000	9,642,348,000
1924	54,413,403,000	43,893,403,000	12,600,000,000	25,092,873,000	6,200,530,000	10,520,000,000
1925*	59,517,000,000	47,997,000,000	13,670,000,000	27,867,000,000	6,460,000,000	11,520,000,000

*Based upon ten months' operations. †1920-1925 as collected by U. S. Geological Survey.

Table II—Sources of Central-Station Gross Income, 1921 to 1925

(100 per cent of the industry)

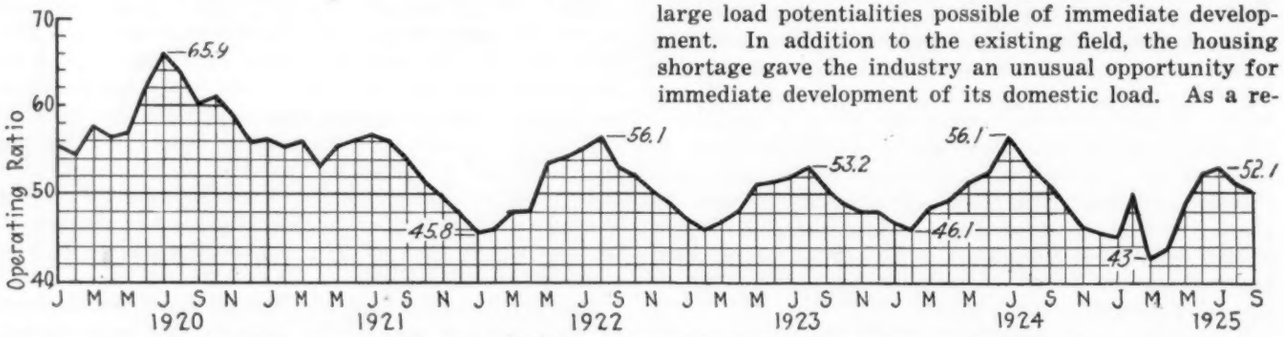
Year	Total Gross Income	Received from Lighting Customers	Received from Power Customers	Received from Electric Railways	Received from Other Public Utilities
1921..	$944,400,000	$570,500,000	$267,800,000	$44,650,000	$61,450,000
1922..	1,072,119,883	657,119,883	303,200,000	50,750,000	61,050,000
1923..	1,269,550,000	795,000,000	358,150,000	52,200,000	64,200,000
1924..	1,354,570,000	902,670,000	321,000,000	54,400,000	76,500,000
1925*.	1,470,000,000	988,000,000	349,000,000	54,000,000	79,000,000

*Based on ten months' operations.

in July being 17 per cent above the estimated normal based upon operations in that section during the past five years. This accelerated growth in the activities of the companies operating in the Southern States was to be expected. This section was behind the other sections of the country in the adoption of electrical energy into its homes and factories, and the South is simply catching up with the rest of the nation today.

There are, however, two or three very significant trends indicated in the operations of the electric light and power industry during 1925. The opening of the present decade found America emerging from the greatest war of all history, a war in the consummation of which this country had completely subsidized her domestic, industrial and civic life, assuming for the period of the war an artificial mode of life which brought into tension every nerve of the national structure in all its ramifications. Economists, psychologists and students of social and industrial affairs were dubious of the future in store for the country. Would the reaction of the war strain result in a decadence of American home life? Would industry in all its multitudinous branches fall back exhausted from the terrific pace set by the war? The answer to these forebodings was the answer of America electrified, not the America of pre-war conditions, but an America which had drawn into her being a life-giving fluid that had permeated into every branch of the social and industrial structure and that had made war efficiency and economy a permanent condition in the industrial and home life of the country. The great strides in electrically operated machinery, in illumination and in the reliability necessary for superproduction had created but a desire for more and more of this heretofore unappreciated servant of industry. The home had felt the labor-saving influence of the vacuum cleaner and the washing machine, the cleanliness and the efficiency of the electric range and iron and toaster. So it may truly be stated that as the result of the proficiency displayed by the electric light and power companies in meeting war conditions the industry really entered into its own at the close of the war and the opening of the post-war decade.

But despite the record growth recorded by the industry from 1913 to 1920, the end of the period found only 32.8 per cent of the population of the nation living in electric-lighted dwellings and only approximately 45 per cent of industry electrified. The opening of the present decade, therefore, found the electric light and power industry riding on a wave of increasing popular good will and necessity and also facing a field pregnant with large load potentialities possible of immediate development. In addition to the existing field, the housing shortage gave the industry an unusual opportunity for immediate development of its domestic load. As a re-



THE OPERATING RATIO HAS MATERIALLY DECREASED SINCE THE OPENING OF THE DECADE

Table III—Activities of the Central-Station Industry by Sections, 1920 to 1925

(100 per cent of the industry)

Section	1920	1921	1922	1923	1924	1925†
	Energy Generated, Kilowatt-Hours*					
United States	39,518,903,000	36,970,697,000	43,559,677,000	51,132,883,000	54,413,403,000	59,517,000,000
New England	2,848,703,000	2,685,665,000	3,160,550,000	3,664,602,000	3,748,536,000	4,158,000,000
Atlantic	14,180,567,000	12,981,516,000	15,709,032,000	18,695,901,000	19,694,478,000	21,323,000,000
North Central	12,139,129,000	11,501,270,000	13,436,664,000	15,614,068,000	16,644,922,000	18,014,000,000
South Central	2,502,024,000	2,452,786,000	2,826,224,000	3,380,984,000	3,791,011,000	4,428,000,000
Mountain-Pacific	7,848,480,000	7,349,460,000	8,427,207,000	9,777,328,000	10,534,456,000	11,594,000,000
	Gross Revenue from Sale of Energy					
United States	$882,750,000	$944,400,000	$1,072,119,883	$1,269,550,000	$1,354,570,000	$1,470,000,000
New England	84,570,000	89,050,000	103,885,016	120,200,000	126,655,000	143,000,000
Atlantic	312,760,000	342,970,000	387,811,179	476,500,000	507,155,000	533,000,000
North Central	298,680,000	314,600,000	358,079,391	418,350,000	445,150,000	482,000,000
South Central	68,050,000	77,020,000	76,134,431	103,000,000	105,610,000	117,000,000
Mountain-Pacific	118,690,000	120,760,000	146,209,866	151,500,000	170,000,000	195,000,000
	Operating and Maintenance Expenses‡					
United States	$440,000,000	$432,400,000	$481,570,000	$576,880,000	$617,980,000	$659,000,000
New England	46,470,000	40,150,000	50,000,000	57,600,000	58,286,000	65,000,000
Atlantic	150,655,000	151,925,000	175,800,000	219,000,000	221,320,000	248,000,000
North Central	160,035,000	160,925,000	171,300,000	202,000,000	214,094,000	232,000,000
South Central	35,980,000	38,000,000	34,200,000	46,100,000	50,750,000	48,000,000
Mountain-Pacific	46,860,000	41,400,000	50,270,000	52,180,000	73,530,000	66,000,000

*Data collected by U. S. Geological Survey. †Based on operations during first ten months. ‡Do not include interest, taxes, depreciation or sinking fund.

Table IV—Operations of Central-Station Hydro and Fuel Power Plants, 1923 to 1925*

(100 per cent of the industry)

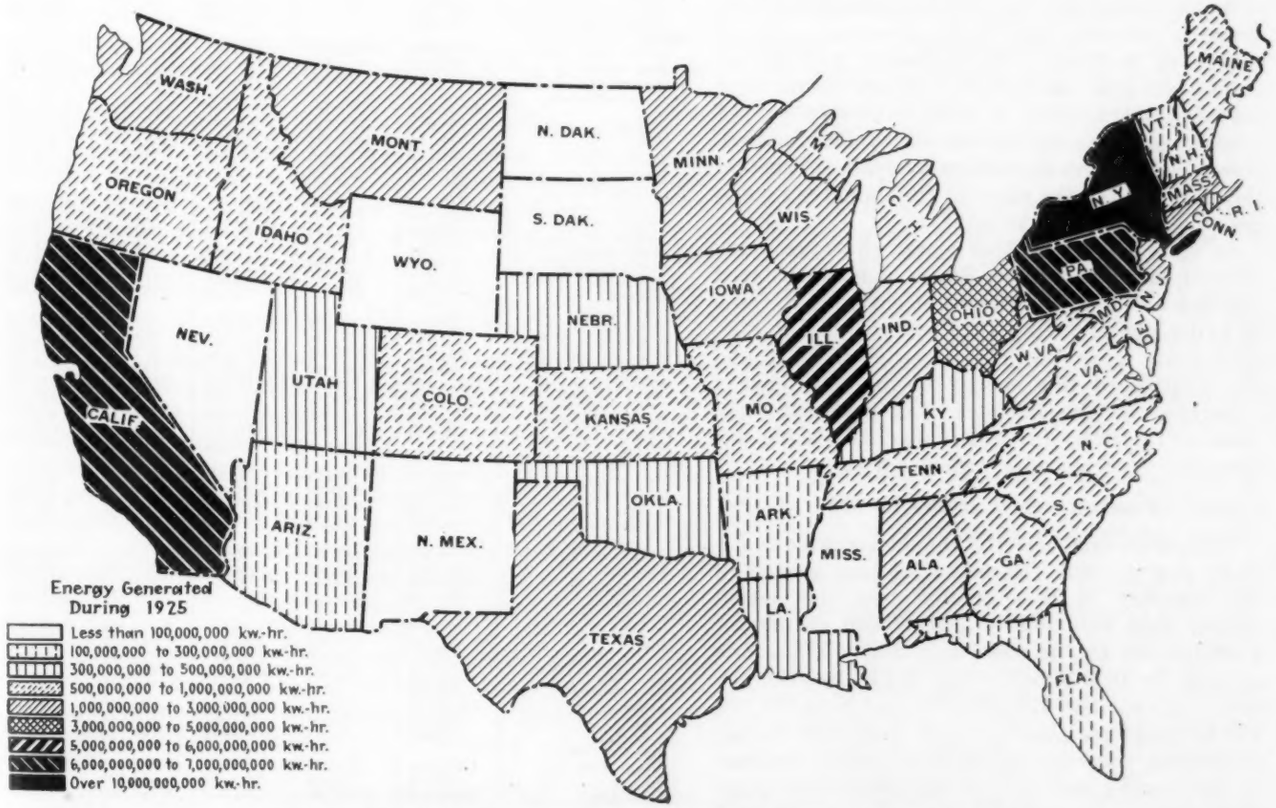
Section	Energy Generated During 1923				Energy Generated During 1924				Energy Generated During 1925†			
	Hydro Plants		Fuel Power Plants		Hydro Plants		Fuel Power Plants		Hydro Plants		Fuel Power Plants	
	Thousands of Kw.-Hr.	Per Cent of Total	Thousands of Kw.-Hr.	Per Cent of Total	Thousands of Kw.-Hr.	Per Cent of Total	Thousands of Kw.-Hr.	Per Cent of Total	Thousands of Kw.-Hr.	Per Cent of Total	Thousands of Kw.-Hr.	Per Cent of Total
United States	19,113,352	37.4	32,019,531	62.6	19,646,801	36.1	34,766,602	63.9	21,570,000	36.2	37,947,000	63.8
New England	1,215,591	33.2	2,449,011	66.8	1,394,860	37.2	2,353,676	62.8	1,490,000	35.8	2,668,000	64.2
Middle Atlantic	4,074,499	31.0	9,069,637	69.0	4,518,290	32.5	9,381,381	67.5	4,700,000	30.8	10,540,000	69.2
South Atlantic	2,031,162	36.6	3,520,603	63.4	2,288,369	39.4	3,506,438	60.6	1,883,000	31.0	4,200,000	69.0
East North Central	1,484,306	12.4	10,542,089	87.6	1,694,864	13.0	11,396,240	87.0	1,532,000	10.8	12,730,000	89.2
West North Central	1,043,678	29.1	2,543,995	70.9	1,200,158	33.8	2,353,660	66.2	1,320,000	35.2	2,432,000	64.8
East South Central	992,612	54.3	834,479	45.7	1,032,503	51.6	968,878	48.4	873,000	35.8	1,565,000	64.2
West South Central	8,413	0.5	1,545,480	99.5	10,430	0.6	1,779,200	99.4	23,000	1.2	1,967,000	98.8
Mountain	2,386,333	87.4	340,229	12.6	2,468,235	86.5	381,201	13.5	2,512,000	84.3	467,000	15.7
Pacific	5,876,758	83.4	1,174,008	16.6	5,039,092	65.6	2,645,928	34.4	7,237,000	84.1	1,378,000	15.9

* Data collected by U. S. Geological Survey. † Based on operations during first ten months.

sult of these very favorable conditions the past six years has witnessed an unprecedented growth in the operations of the electric light and power industry, until today 63,100,000, or 54.4 per cent of the population of the nation, are living in electrically lighted dwellings and industry is approximately 65 per cent electrified, including electrification from private generating plants.

With the number of persons living in electrically lighted dwellings rapidly approaching the population of the cities, towns and villages of the country, and with the gradual overcoming of the housing shortage, it is but natural to expect that the number of new domestic lighting customers added each year would not continue indefinitely at the rate established in 1923 and 1924, approximately a million and three-quarters each year. There is an economic limit to any type of growth. Reports received from operating companies throughout the country indicate that this limit of maximum customer growth has been reached and that in the future the growth in number of domestic customers must conform more and more to the normal growth in population. The number of new domestic customers added in 1923 was 1,698,000; in 1924 it was 1,783,000, and in 1925 it was 1,131,000. It is probable that 1926 will show fewer new customers than in 1925, and this number must gradually decrease until the normal of around 200,000 per annum is established, this being approximately the normal number of homes constructed per year.

A direct reflection of this decrease in the number of high-revenue domestic customers taken on during 1925 is to be found in the decreased growth in the gross revenue of the industry. Throughout the year the gross revenue of the industry has been between 2 per cent and 7 per cent under the normal based upon the revenue as reported for the past five years. The estimated revenue for 1925 is $1,470,000,000, whereas if the growth estab-



NEW YORK EASILY LEADS IN THE TOTAL CENTRAL-STATION ENERGY OUTPUT

Table V—Consumption of Fuel by Central-Station Steam Power Plants, 1923 to 1925*

(100 per cent of the industry)

Section	Coal (Short Tons)			Fuel Oil (Barrels)			Gas (Thousands of Cubic Feet)		
	1923	1924	1925†	1923	1924	1925†	1923	1924	1925†
United States	28,712,580	32,556,970	35,488,800	13,915,128	16,096,675	9,869,000	29,287,251	46,993,070	47,313,400
New England	1,682,432	1,884,273	2,145,000	2,209,636	1,602,506	950,000	0	0	0
Middle Atlantic	8,566,047	9,253,926	10,740,000	199,729	225,881	228,000	625,084	370,589	197,400
South Atlantic	2,687,891	3,199,255	3,735,000	1,154,766	1,254,031	1,580,000	2,066,330	1,118,399	422,500
East North Central	10,855,086	12,831,055	12,860,000	35,342	43,487	57,800	5,210,067	2,851,487	8,120,000
West North Central	2,873,986	3,052,271	3,020,000	1,858,957	1,498,662	1,055,000	2,812,052	3,663,729	5,625,000
East South Central	1,139,998	1,232,379	1,750,000	201,428	221,183	165,200	127,274	93,752	34,000
West South Central	359,277	458,889	514,000	4,484,438	4,082,844	3,043,000	11,633,219	16,299,211	22,800,000
Mountain	503,327	588,746	662,500	292,946	250,944	210,000	136,930	194,673	154,500
Pacific	44,536	56,176	62,300	3,477,886	6,917,137	2,580,000	6,676,295	22,401,230	9,960,000

*Data collected by U. S. Geological Survey. †Based on operations during first ten months.

lished from 1920 to 1925 had been maintained during 1925 the revenue for the year would have totaled around $1,500,000,000, or $30,000,000 more than the actual revenue reported for the year. It must be remembered, of course, that the rates for electrical energy have on the whole been on the decrease. In 1920 the average retail rate for energy used for lighting was 8 cents and the average wholesale and retail rate was 7.4 cents. By 1925 these figures had decreased to 7.5 cents for retail customers and 6.9 cents for wholesale and retail customers. This may appear to be a small decrease, but when applied to the billions of kilowatt-hours sold for lighting purposes, it becomes a matter of tens of millions of dollars. If the 1920 rate for lighting had been maintained in 1925, it is estimated that the gross revenue for lighting customers alone would have exceeded the estimated total of $988,000,000 by approximately $70,000,000.

The industry is confronted with the concrete fact that if it is to maintain its past growth in energy consumption by high-revenue customers it must make the increased consumption per domestic customer one of its foremost tasks in the years to come. The domestic field is far from saturated electrically. Every home is a potential market for a more extensive use of electrical appliances and increased illumination. How well the central stations cultivate this potential field will tell the story of the industry's gross revenue in the years to come.

In spite of the serious water shortage experienced in the Southern States during the past summer and fall, the amount of energy generated in hydro plants during 1925 was two billion kilowatt-hours more than that reported in 1924, and the relation of this energy to the total energy generated by the industry was practically the same as in 1924. In 1924 it was the Pacific section that experienced a water shortage.

PROBABLE OPERATIONS IN 1926

Central-station activity should increase materially during 1926. Based on the past growth of the industry, it is estimated that the output during 1926 will total 63,700,000,000 kw.-hr., or 4,200,000,000 kw.-hr. more than that of 1925. The revenue in 1926 should total $1,570,000,000, the operating expenses $705,000,000, and $734,350,000 will be spent for additions and extensions to the generation, transmission and distribution systems of the country and for new administrative quarters, warehouses, garages, etc. The end of 1926 should find a total of 18,800,000 customers, approximately 66,000,000 persons living in electrically lighted dwellings and about $8,400,000,000 invested in the industry. There is every indication that 1926 will be another large year for the central-station industry.

Table VI—Electrical Energy Generated in Public Utility Plants

Includes energy generated by central stations, electric railways and certain other plants that contribute to the public supply.

State and Section	Electrical Energy Generated (Thousands of Kilowatt-Hours)				
	1921*	1922*	1923*	1924*	1925†
United States	40,975,617	47,659,004	55,674,435	59,013,590	64,740,000
New England	3,214,189	3,729,873	4,275,836	4,334,553	4,871,000
Middle Atlantic	11,172,532	13,061,880	15,413,092	16,305,735	17,980,000
East North Central	9,228,704	10,876,270	12,768,916	13,791,109	15,036,000
West North Central	3,207,360	3,568,462	3,975,852	3,934,166	4,149,000
South Atlantic	4,032,499	4,839,688	5,708,223	5,949,906	6,278,000
East South Central	1,311,328	1,551,732	1,890,000	2,063,570	2,538,000
West South Central	1,329,321	1,463,026	1,693,367	1,923,075	2,135,000
Mountain	1,851,550	2,389,941	2,838,915	2,963,081	3,108,000
Pacific	5,628,134	6,178,132	7,110,234	7,748,395	8,645,000
New England					
Maine	351,054	405,002	452,892	473,671	533,000
New Hampshire	171,811	195,571	195,705	215,806	252,000
Vermont	112,452	137,292	155,344	223,793	266,000
Massachusetts	1,603,959	1,849,911	2,093,161	2,097,998	2,372,000
Rhode Island	344,863	411,437	517,230	427,493	433,000
Connecticut	630,050	730,660	861,504	895,792	1,015,000
Middle Atlantic					
New York	6,170,706	7,420,778	8,722,289	9,288,569	10,050,000
New Jersey	960,225	1,112,438	1,250,606	1,304,297	1,500,000
Pennsylvania	4,041,601	4,528,664	5,440,197	5,712,869	6,430,000
East North Central					
Ohio	2,520,382	3,042,888	3,587,841	3,701,562	3,960,000
Indiana	905,617	1,076,944	1,261,097	1,297,676	1,407,000
Illinois	2,984,134	3,482,932	4,070,967	4,665,472	5,210,000
Michigan	1,901,752	2,179,944	2,580,399	2,696,648	2,912,000
Wisconsin	916,819	1,093,562	1,268,612	1,429,751	1,547,000
West North Central					
Minnesota	733,124	787,589	857,931	869,866	1,033,000
Iowa	989,209	1,041,953	1,109,719	1,175,068	1,184,000
Missouri	722,320	871,026	1,060,976	888,755	815,000
North Dalota	31,484	32,314	36,116	39,296	38,000
South Dakota	51,264	56,084	62,053	65,909	67,000
Nebraska	264,729	283,575	316,684	337,902	367,000
Kansas	415,230	495,921	532,373	557,370	645,000
South Atlantic					
Delaware	71,121	84,599	90,267	87,977	97,000
Maryland	237,249	394,133	510,553	482,346	642,000
Dist. of Columbia	265,417	282,366	301,298	315,227	347,000
Virginia	542,606	643,943	729,641	743,668	788,000
West Virginia	1,102,183	1,351,438	1,710,883	1,762,737	1,633,000
North Carolina	348,569	442,717	632,317	647,330	888,000
South Carolina	769,699	868,768	894,893	943,577	910,000
Georgia	550,964	611,314	656,046	748,756	689,000
Florida	144,691	160,410	182,325	218,288	284,000
East South Central					
Kentucky	285,163	314,675	352,274	405,194	473,000
Tennessee	489,969	512,494	649,484	694,073	862,000
Alabama	474,390	664,404	823,216	890,087	1,124,000
Mississippi	61,806	60,159	65,026	74,216	79,000
West South Central					
Arkansas	124,452	130,564	147,675	154,682	185,000
Louisiana	235,091	249,829	282,580	308,262	314,000
Oklahoma	214,618	265,841	290,495	331,157	384,000
Texas	755,160	816,792	972,617	1,128,974	1,252,000
Mountain					
Montana	596,610	984,972	1,138,545	1,145,285	1,238,000
Idaho	550,149	615,783	694,871	792,532	752,000
Wyoming	37,855	38,985	48,853	53,556	62,000
Colorado	362,651	403,475	461,570	490,030	528,000
New Mexico	15,768	17,140	18,268	19,913	22,000
Arizona	132,434	144,615	157,183	153,196	135,000
Utah	119,551	145,689	272,577	266,946	335,000
Nevada	36,532	39,282	47,048	41,623	36,000
Pacific					
Washington	1,176,662	1,285,625	1,446,486	1,503,560	1,818,000
Oregon	468,534	512,804	594,434	678,395	737,000
California	3,982,938	4,379,703	5,069,314	5,566,440	6,090,000

*U. S. Geological Survey data. † Based upon ten months' operations.

The Holding Company and Finance

A Bulwark of Strength to Smaller Properties, Insuring Greater Security to the Investor, Better Service to the Consumer and Efficient Development of the Industry

By S. Z. MITCHELL
President Electric Bond & Share Company

THE electric light and power industry occupies the enviable position of being able to sell its product at reduced cost while the cost of nearly everything else that enters into modern life has gone up. We in the industry know the factors which make this possible, but to those outside the breastworks the accomplishments appear to be nothing short of miraculous.

The monopolistic nature of the electricity supply business is now very generally recognized and accepted; but the tendency toward consolidation of management, production and distribution, notwithstanding the great and proven economies resulting therefrom, is still looked upon with misgiving, because it is as yet imperfectly understood.

Nothing in connection with the electric light and power business is so obvious to those engaged in it or who have studied the problem as large generating systems, large interconnections, large producing companies and large financial needs. Nevertheless, until the situation becomes as obvious to the public as it is to us the industry will be under suspicion of financial jugglery.

Unfortunately many within the industry itself do not comprehend the whys and wherefores of consolidations; just as there are many bankers who do not fully understand the Federal Reserve banking system. These operators know with certainty the effect of diversity factor, high station load factor, interconnection, mass production in huge water-driven or steam-driven stations; they know in fact all the engineering advantages accruing from proper co-ordination of generating facilities; but they do not envisage the larger issue which complete correlation involves.

HOLDING COMPANY THEORY ADMIRABLE

The holding company is, to many, an enigma. To me the theory is admirable. It scatters the risk and affords intelligent supervision and the highest type of engineering; it cheapens the cost of supplies and by giving a broader market for capital also cheapens the cost of money. The latter advantages are obtainable only because the issues are large and warrant the complete and careful investigation of investment bankers; they create a broad market in which investors can buy and sell readily and one large enough to have many minds concentrating on the facts back of the security, thereby making the securities better collateral because they are readily marketable. More people know about the companies and their securities, which acquire a more stable market representing the combined judgment of many investors.

There is nothing new or untried in this. The principle of large volume and diversification as applied to various risks in order to stabilize results through the law of averages has been followed for over 200 years by the great insurance companies of the world and has demonstrated its soundness when applied through holding companies to the operation of electric light and power properties. It is an easy matter to prove conclusively that by means of the holding company not only is greater safety secured for the investor and better service at lower cost for the consumer but that capital is also more readily obtainable and on better terms.

Few men not actually engaged in raising capital for public utility work realize how great an amount of new money must be provided yearly to take care of a normal growth of the utility company. Experience has shown that on the average a property investment of four dollars and in some cases six dollars is required to produce one dollar per annum of gross revenue. If the needs of the community are properly served, the gross revenue of a public utility company will grow at a nominal rate of say 8 per cent a year. On the basis of this conservative average of four dollars capital investment to get one dollar per year gross revenue the accompanying tabulation shows the approximate amount of new money required each year up to the year 1935.

Table I—New Capital Requirements of Company on 8 per Cent Growth

Year	Gross Earnings	Inc.	New Capital—Amount	New Capital—Cumulative
1925	$14,811,500	.....	.....	.....
1926	15,996,400	$1,184,900	$4,739,600	.....
1927	17,276,100	1,279,700	5,118,800	$9,858,400
1928	18,658,200	1,382,100	5,528,400	15,386,800
1929	20,150,900	1,492,700	5,970,800	21,357,600
1930	21,763,000	1,612,100	6,448,400	27,806,000
1931	23,504,000	1,741,000	6,964,000	34,770,000
1932	25,384,300	1,880,300	7,521,200	42,291,200
1933	27,415,000	2,030,700	8,122,800	50,414,000
1934	29,608,200	2,193,200	8,772,800	59,186,800
1935	31,976,800	2,368,600	9,474,400	68,661,200

That is to say, a company with gross earnings of $15,000,000 in 1925 will have to augment its capital $68,000,000 by 1935 to take care of an 8 per cent yearly growth in income.

The record of a company like the Detroit Edison Company, for example, bears out this estimate as shown by the increase in capitalization which has taken place in that company in the period from 1915 to 1924.

Thus during the decade the gross earnings increased approximately $26,000,000 and the total capitalization $100,000,000. While the growth in so enterprising a city as Detroit has been greater than 8 per cent per annum the ratio of capitalization to earnings has been with fair consistency four to one. The point I wish

to make, however, is that growth involves capital expenditure on a huge and continuous basis.

The older companies operating in large cities and with well-seasoned securities manage to raise the vast sums required with comparative ease; but the smaller utilities are not so happily situated and that is why the holding company is so advantageous to such properties in securing money when needed and which the small company in most instances cannot obtain at all. By converting or combining numerous small corporate security issues into one large issue about which the investing public can form its judgment without the necessity of the specialized information that it must have in the case of many small separate corporate organizations, cheaper money and a wider security market are obtained.

Table II—Earnings and Capitalization of Detroit Edison Company

Year	Gross Earnings	Total Capitalization
1915	$7,759,932	$37,108,800
1916	10,066,786	43,583,800
1917	12,279,926	48,909,000
1918	13,801,527	55,385,000
1919	16,498,391	62,948,000
1920	21,990,351	78,471,100
1921	23,382,898	92,311,500
1922	26,408,159	103,517,800
1923	31,724,184	112,216,100
1924	34,163,286	136,511,700

One of the most important elements in the value of a security is its marketability. The usual investor is not content with knowing that his investment is secured. He seeks an investment of a type on which he can readily borrow or which he can easily sell in case of necessity. Ready marketability comes with uniform issues of large volume—issues that are widely known and with the values of which many investors are familiar.

Money Needed to Create Properties

Now the great trouble with new or little known electric utility companies is not confined to operation. Without the money to create the properties there is nothing to operate. It is difficult to get the funds to start the little companies, and once started—often as the result of civic pride—it is even more difficult to find the money to provide for their growth. Bonds and preferred stock can be sold if some one will put up sufficient equity. For instance, for every dollar of common stock put into a property, another dollar can be raised through the sale of preferred stock. The latter stockholder is doubly secured by his own dollar plus the common-stock dollar. With one dollar of common stock and one dollar of preferred stock, a sound and well-managed company should always be able to command three dollars of bond money, and that proportion will hold no matter how large the property may become. The whole structure is, however, built upon the money placed in the common stock, and that money is the hardest for small companies to raise.

It is not a rare thing for many of the underlying properties in a holding company group to show a loss in operations. Improvements in service and reductions in rates leave their effect at first until the business is built up. Statements from many of the properties under holding company management have many figures in red; but owing to the diversity factor in earnings the consolidated earnings statement of the larger holding companies tells an entirely different story. There is not a red figure on it. The industry like the country is going forward, and if care is exercised in choosing properties so as to obtain ample diversity, properly conceived and properly managed the pathway of the holding company should be always upward.

Holding Company Sustains Unit Properties

Whatever the viscissitudes of the individual companies may be, the holding company is there to help and sustain them. The strength of the holding company lies in its ability to obtain better and more economical results from a group of operating companies than those properties can give if operated as individual units. Where certain properties are close together other economies are effected by interconnection. For example, some stations require a pound and a half of coal to develop a kilowatt-hour of energy while others may require three pounds. Or a water-power station may be operating at partial load and wasting water while a steam station close by is burning coal. Normally the sensible thing to do is to interconnect these stations, but with diverse ownership this is not always easy. Where, however, a holding company gathers the various properties under its wing such interconnection and consolidation of operations becomes a simple matter and results in great economy. It is the inclusion of the diversity of demands and requirements of numerous communities which makes mass production possible with low costs and greater reliability of service.

There are those who profess great alarm over the activities of the holding companies, maintaining that recent consolidations have in view rate increases or financial advantage at the expense of the ultimate consumer. As a matter of fact these corporate combinations have been made for the purpose of effecting legitimate economies which result to the advantage and not the disadvantage of the ultimate consumer. The various state commissions still regulate the rates for service charged by the underlying companies, and experience has shown that as a result of holding company management electric service in the main has been improved and extended to communities which left to their own resources would at best only be able to have an indifferent service at much higher rates.

Large Business Produces Economies

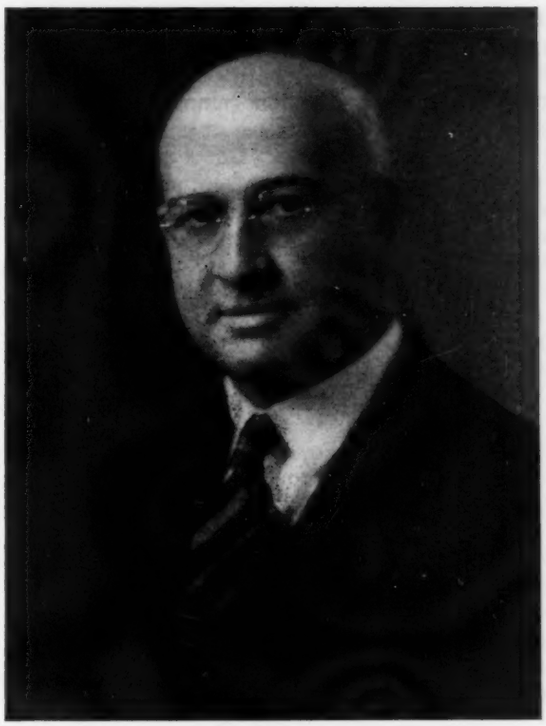
During recent years, when consolidation of electric properties has been most active, statistics show that the rates to the ultimate consumer have been lowest, notwithstanding all the elements which go to make up the service are many times higher. This of itself is sufficient vindication of the holding company and a fact which no demagogue has been able to refute. People generally recognize the truth of the maxim that in union there is strength and also admit that large business is capable of economies not possible of attainment by small business.

In the electric light and power industry the history of responsible holding companies has been one of accomplishment, as numerous communities are able to testify. Honestly managed and financed holding companies have also been a boon to the industry, contributing as they have expert financial, technical and commercial services of an exceptionally high order.

The Challenge to Commercial Men

By JAMES E. DAVIDSON
President
National Electric Light Association

Electric Light and Power Industry Needs a Better Merchandising Spirit and Greater Activity in Building Up Residential Load



JAMES E. DAVIDSON

NEBUCHADNEZZAR was one of the really great kings of the earth who made Babylon one of the wonders of the world. But in his vanity he said: "Is not this a great Babylon that I have built?" and soon thereafter he was deposed and his kingdom finally went to smash.

Many of our industry refer continually to our size—how great and mighty our investment is. In picturesque and romantic language we frequently tell how from the little Pearl Street station our industry has developed into one of seven billion dollars' value—second only to the steam railroads. We have heralded to the world that we pay one hundred and fifty millions of dollars in taxes and that two and one half million persons hold public utility securities. It is a great story indeed and makes a big hit always, for success stories are now as popular to the average American as Diamond Dick stories were in our youth.

But have we heralded to the American people the complete story of our industry? Have we told them what the gross earnings of the electric service companies are in comparison with the earnings of other businesses? Comparisons readily show us that our earnings do not rank so far up the column as one would think, with our great investment picture in the foreground.

If we compared our local gross earnings with those of department stores, motion-picture theaters and some manufacturing concerns in the same city or town, we should discover that as business getters we are not such large "pumpkins" after all. Set our average residential yearly bills at $20 alongside of the average family bill for meat, groceries or rent, and you will find the electricity bill the lowest item of all.

Every one seems to be outselling us!

Think of it! We turn our capital only once in five years. More than 95 per cent of our companies utilize their investment less than half of the time—most of these less than 40 per cent of the time—and many have load factors of below 30 per cent. Successful merchants turn their capital five times a year—25 times as often as we turn ours. A page might be taken from the sales program of our sister utility industries—the telephone and telegraph—in the improvement of their load factors in selling their communication service at off-peak periods. By changing the load factor from 40 per cent to 80 per cent we could cut our fixed charge almost in two. I will wager that Henry Ford's plant at Detroit has a load factor of more than 80 per cent. So do many other manufacturing plants which operate day and night as do our power stations. Their sales organizations keep them going and make their high load factors.

I have contended for several years that any company with a reasonably good organization and with sufficient credit can build a physical property, but it requires a well-organized operating and sales organization to bring complete success.

Most of the business which electric utilities now have has naturally gravitated to our lines because of the many uses to which our service could be conveniently put and at the lowest cost. We carried on but little saleswork to obtain it. Sales activity alone will take the unprofitable valleys out of the landscape of the electric light and power industry. No man should treat the sales field lightly, trusting to good luck and snap judgment. Our sales organizations should be manned by trained salesmen having knowledge, spirit, imagination and enthusiasm.

Our electric light and power companies need some Wanamakers, Marshall Fields and Filenes as our new business and merchandising leaders. Bruce Barton has the remedy. He hit us between the eyes with his message of "How long should a wife live?"—telling us that the American housewife is working away at a coolie's wage of three cents an hour and neglecting the highest work intrusted to human beings—the work of motherhood. As Mr. Barton said, we do expect to electrify the American home some day—why not do this job now?

Statistics of our government inform us that but 6 per cent of American homes have servants. Think of what our motor-driven devices and heating appliances can do to remove drudgery and bring comfort and happiness into the 94 per cent of homes which have no servants. And yet only 49 per cent of our light and power companies do merchandising business!

Chairman Lloyd of our Commercial Section and I are

by no means alone in our belief that every electric company should do an active merchandising business. Such a department should be headed by an experienced sales manager, with compensation commensurate with that paid buyers for such departments in department stores. We should cut out writing our own advertisements and have this important work done by advertising experts, take more space and have it properly placed. Show windows should be trimmed by window trimmers—not cashiers or meter readers. Let's be real merchandisers. The result will be increased kilowatt-hour sales and, by good merchandising management, a real profit on goods sold. Specialty salesmen should solicit present users of power service and be on the heels of new "prospects."

Electric heating business should be vigorously followed up.

The domestic electric refrigerator, with its advantages in the preservation of food and economy of operation, is a complete success. Central-station companies are the logical distributors. Our customers look to us to sell it to them and do the little servicing which is necessary. This refrigerator business will give us revenue of $30 to $40 yearly per home from a virgin field. It will boost residential earnings from about $20 to $50 yearly with little increased investment and operating expense. Refrigerator units are not marketable alone in the homes of the rich. With our remarkable credit relation with our customers more than 50 per cent of our residential consumers are prospective buyers. One does not have to let his imagination run riot to realize that this new business will increase our load factors and turn our capital more frequently.

What wouldn't any merchant or any manufacturer give for some one natural and valuable sales advantage? We have a non-competitive business. Almost every one in the cities we serve is connected to our lines—they are now our customers. Our 24-hour-operated power stations all have for sale from 50 per cent to 75 per cent of their kilowatt-hour output. The cost of our service is the lowest item in the factory or home budget.

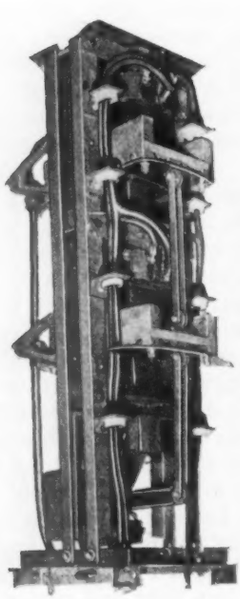
We have a regular monthly transaction with every customer. Our service is delivered direct; there is no middleman, and we sell our service to the rich and the poor from the same rate schedules. Our customers know that they must pay their bills promptly, and they do so, because we cannot discriminate. This makes a remarkable and valuable credit situation in selling merchandise to our customers, meaning everybody in the cities which we serve.

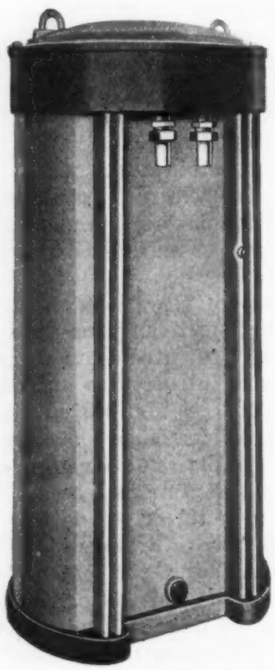
Father Time is ticking away minutes which are precious to light and power companies. Our properties are selling less than half of the available kilowatt-hours. Drudgery and inconvenience prevail in our customers' homes. We can do the apparently impossible and beat Father Time—serve our customers adequately—increase our earnings and be better employees of our shareholders. All that is required is sufficient interest in the sale of energy and in merchandising, "bang-up" sales organization, careful planning and the expenditure of good hard energy.

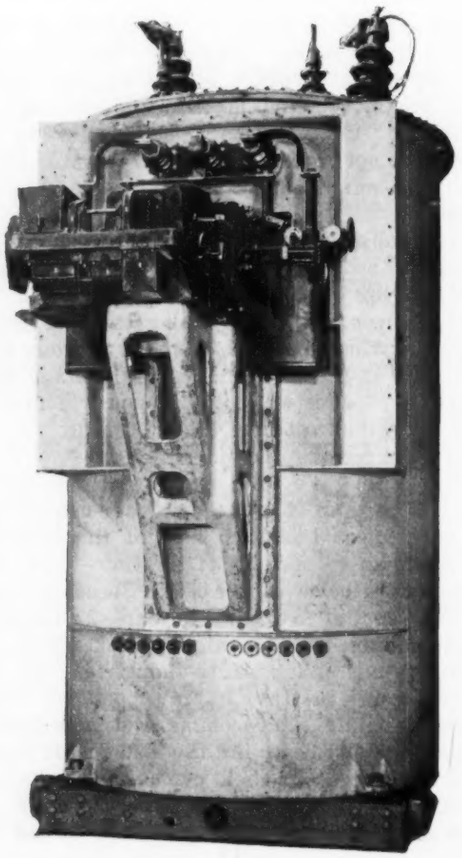
New Developments in Transformers

At the Right: Tap changing transformer under load with motor operation and push-button control (Westinghouse).

Below: A manhole type constant current street lighting transformer (Westinghouse).



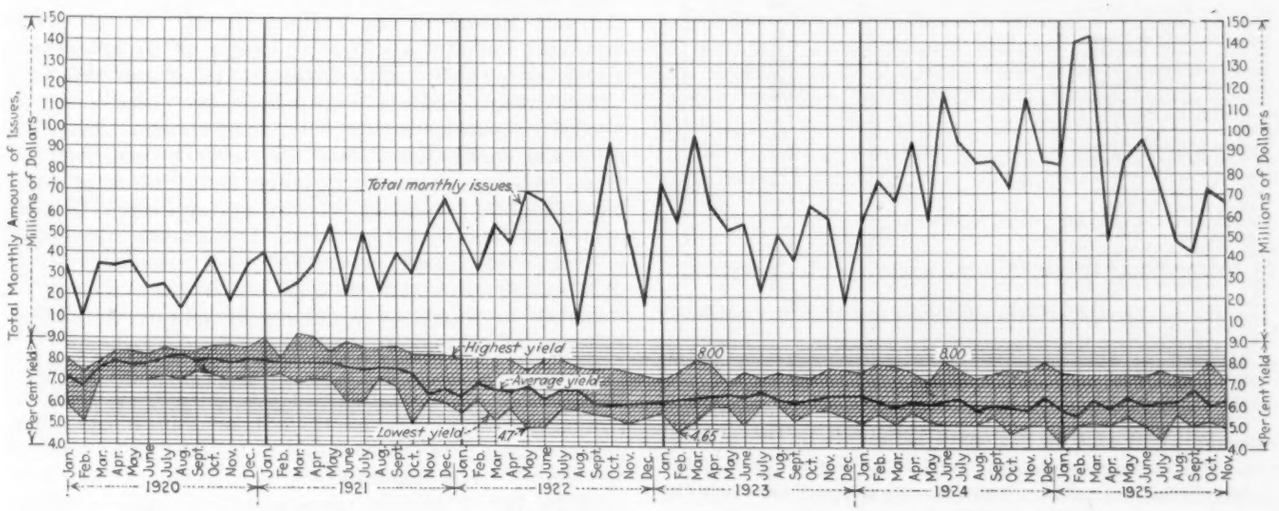




Financing in 1926 Should Set Peak

Public Utility Companies May Need $1,300,000,000 to Aid Growth —Money Should Be Obtainable on Terms More Favorable than Ever—Big Mergers Facilitate Economies

By PAUL WILLARD GARRETT
Financial Editor New York Evening Post



38 PER CENT OF THE TOTAL NEW FINANCING WAS PLACED DURING THE FIRST QUARTER OF THE YEAR

MORE than a billion and a quarter dollars is what the people of this country invested in the electric power and light industry during 1925, a greater amount than had ever been absorbed in any previous year, and still another $1,300,000,000 probably will be put into the securities of this industry in 1926. Already the total invested capital of the industry has reached $7,500,000,000, and within the present calendar year this amount is more likely than not to be swelled to $8,400,000,000. That sum would represent what is invested in the power and light branch alone of the electrical industry.

Swiftly the financial growth of the electrical industry as a whole, through unprecedented expansion in the power and light branch, is stepping into a position of first rank among the country's industries of large capital investment. An aggregate capitalization of roughly $17,000,000,000 must now be recorded for the electrical industry when account is taken of power and light companies, electrical manufacturing companies, electric railways, telephone and telegraph companies and electrical merchandising companies. Within two years the electrical industry will pass the steam railroads in the volume of capital invested and thus take the position of first place long held by the carriers. In time the electric power and light companies themselves almost certainly will represent a larger capitalization than the railroads. Another ten years will be required in expansion work for the power and light business, whereas growth in railroad mileage virtually stopped years ago. Even when the industry slows down its activity in making new service connections, it may look forward to a long period of intensive growth through the introduction of devices that will raise the per capita load. A railroad can stretch its lines to all of the sizable towns in a district, but it cannot expect thereafter to increase its loadings beyond a certain point; an electric power and light company may, even after it has stretched its wires to every home in a community, reasonably hope in time to double or treble its original load through popularization of electric refrigerators, washing machines, vacuum cleaners, electric ranges and electric heaters. Physical growth of the industry involves the expenditure of huge sums and, so far as can be seen, will call for an investment of a billion dollars or more a year for some time to come.

So keenly does the industry realize its dependence upon funds to be provided by the nation's investors that nowadays the managements are giving about as much attention to the building of strong financial structures as to the construction of sound physical properties. Banking houses all over the country have studied the peculiarities of the industry as they have never studied any industry in history in their effort to provide capital structures that will stand the tests of time and protect at once both investors and companies. Rapidly as the industry is growing and large as are the amounts that it needs yearly, confidence in utility securities is spreading every day. Funds each year are coming to the industry on terms more favorable than before. During 1924 the power and light industry marketed its mortgage bonds to the public at prices that represented an average yield of precisely 6 per cent, but during 1925 the average yield of such offerings was only 5.48 per cent. Similarly, in 1924 the industry marketed its debenture obligations at prices that represented an

1925 Net Advance in Stocks

	Close 1924	Close 1925	Year's Net Gain
New York Stock Exchange			
American & Foreign Power (a)	27⅛	40⅜	13⅜
American Water Works & Electric	39	69⅛	30⅛
Brooklyn Edison	120⅞	135	14⅛
Detroit Edison	112	136⅛	24⅛
Havana Electric (a)	112	237	125
Montana Power	71	77⅛	6⅛
North American	42⅜	63½	20¼
Pacific Gas & Electric	103⅛	130⅜	27
Public Service of New Jersey	69½	79⅜	10⅛
Standard Gas & Electric	40⅛	56¼	16¼
New York Curb Market and Unlisted			
American Light & Traction	141	252⅛	111⅛
American Public Utilities	75	80	5
Arizona Power	15	34	19
Arkansas Light & Power	68	147	79
Commonwealth Power (b)	32¼	38¾	6½
Columbus Electric & Power	118	150	32
Commonwealth Edison	133	140	7
Continental Gas & Electric	88	155	67
Central States Electric	77	210	133
Dayton Power & Light	180	430	250
Eastern Texas Electric	72	90⅛	18⅛
Georgia Railway & Power	68	147	79
Jersey Central Power & Light	18	50	32
Lehigh Power Securities	116	179½	63½
Middle West Utilities	94	113½	19½
National Power & Light (d)	16	34½	18½
Northern States Power	105	131⅛	26⅛
Penn Water & Power	110	160	50
Southeastern Power & Light (c)	12	42	30
United Light & Power A	86	128	42

(a) 1924 low.
(b) 1924 closing price of 129 is recorded as 32¼ since the stock was split on a basis of 4 to 1.
(c) 1924 closing price of 60 is recorded as 12 to account for a 5 to 1 split in the shares.
(d) 1924 close of 240 is taken as 16 on account of a 15 to 1 split up.

average yield of 6.25 per cent, although in the present year the average yield was only 5.30 per cent—a yield, incidentally, even lower than that obtained through the sale of mortgage issues. The debentures in some cases were popularized through the attachment of warrants. Preferred stocks in 1924 were marketed on levels that averaged a yield of 7.01 per cent, but in 1925 such offerings were made on a basis to yield an average of only 6.87 per cent.

Prophets who were predicting a year ago that the market in power and light securities soon would collapse must now, if they have given thought to the matter, be astonished at the swing in the investment trend from senior to junior financing. Not only have the utilities been able to obtain money at lower rates than formerly, but what is more significant, they have been doing less financing through the sale of first mortgage bonds and more through the sale of debentures and capital stock. About $1,278,223,010 in electric power and light securities was sold during 1925 as against $1,175,120,000 during 1924, but the volume of mortgage bonds shrank in that period to $496,094,500 from $672,463,600. Increased confidence in the industry's future and the stimulation of the world's greatest bull market for stocks generally enabled the industry for the first time to finance in a large way on favorable terms through channels that formerly were too often closed. Of debentures in 1925 the industry marketed $172,430,000, for example, as against a 1924 total of $132,875,000, and the volume of preferred stock sales grew to $280,198,510 from $175,582,200 in the year before. Sales under the customer-ownership plan rose to $296,000,000 as against $254,000,000 in the year before. All of this reflects an interesting trend toward junior financing, and the industry now is able for the first time in its history to do a substantial amount of its financing through the sale of common stock, $33,500,000 in common shares having been marketed in 1925. The event marks a new era in public utility financing and reveals a distinct trend that in the end will materially raise the quality of all power and light issues through a widespread improvement in the balance between stocks and bonds in the typical capital structure.

Nowhere in the annals of American finance are to be found events more romantic than those surrounding the great utility mergers of the past year. Such combinations in the twelve-month period just ended involved the regrouping of more than five hundred operating and holding companies. The capitalization of the companies absorbed aggregated almost $2,000,000,000. Sound economic reason for merger operations that absorbed over one-quarter of the industry's capitalization lies in the very nature of the business itself. In the power and light industry an invested capital of $7,500,000,000 yields only about $1,500,000,000 in gross revenues, which means that a relatively large investment is needed to produce a relatively small return. Rates for electrical energy are lower than ever before, furthermore, whereas labor, machinery and equipment costs have doubled since the outbreak of war. Greater centralization in the industry, through the absorption of small inefficient companies and combinations of different systems strategically located, is enabling the industry to introduce operating economies and effect substantial savings in financing.

In the stock speculative era that began after the election of President Coolidge in the autumn of 1924 the power and light shares that have won most favor, perhaps, have been those involved in these great merger operations. The imaginations of speculators have been fired by the attractive possibilities of some combinations, and Wall Street traders at times have manufactured rumors, only too often with no other basis than a desire to boom favorite issues. Although power and light stocks have almost universally moved forward in the past year, buyers have, fortunately, come to exercise greater discrimination than previously. It is only natural that the holding companies that have taken an active hand in drawing together various properties have

Electric Light and Power Security Issues in 1925

Public Sales by Investment Houses

MORTGAGE BONDS (average yield 5.48 per cent):	Amount of Issue	
8 issues yielding from 4.35 to 5.00 per cent...	$46,900,000	
14 issues yielding from 5.03 to 5.28 per cent...	59,200,000	
19 issues yielding from 5.30 to 5.50 per cent...	152,554,500	
23 issues yielding from 5.53 to 5.70 per cent...	81,232,000	
9 issues yielding from 5.75 to 5.93 per cent...	22,950,000	
23 issues yielding from 6.00 to 6.13 per cent...	39,908,000	
16 issues yielding from 6.15 to 6.25 per cent...	44,735,000	
9 issues yielding from 6.30 to 6.40 per cent...	19,785,000	
13 issues yielding from 6.50 to 7.00 per cent...	28,830,000	
134 issues		$496,094,500
DEBENTURES (average yield 5.30 per cent):		
4 issues yielding from 4.75 to 5.00 per cent...	$47,800,000	
5 issues yielding from 5.45 to 5.73 per cent...	21,000,000	
13 issues yielding from 5.75 to 6.12 per cent...	38,130,000	
11 issues yielding from 6.15 to 6.37 per cent...	46,030,000	
7 issues yielding from 6.50 to 7.85 per cent...	19,470,000	
40 issues		$172,430,000
PREFERRED STOCK (average yield 6.87 per cent):		
5 issues yielding from 5.81 to 6.00 per cent...	$10,500,000	
8 issues yielding from 6.18 to 6.40 per cent...	64,055,000	
8 issues yielding from 6.60 to 6.90 per cent...	12,825,010	
17 issues yielding from 7.00 to 7.10 per cent...	108,990,000	
8 issues yielding from 7.11 to 7.20 per cent...	36,760,000	
11 issues yielding from 7.22 to 7.29 per cent...	23,456,500	
10 issues yielding from 7.30 to 7.37 per cent...	16,137,000	
7 issues yielding from 7.40 to 8.00 per cent...	7,475,000	
74 issues		$280,198,510
COMMON STOCK		
8 issues		33,500,000
Total of all issues of year		$982,223,010
Estimated local sales to customers		296,000,000
		$1,278,223,010

been favored in the markets over the old and established operating companies. Speculators are attracted by the wide claim on earnings from various operating subsidiaries that the stock of the parent holding company enjoys even when they recognize that dividends are a long way off in many cases. An increase in the number of important holding companies is one of the outstanding developments of the last year and has added to the list such organizations as the Southeastern Power & Light Company, Electric Power & Light Company, New England Public Service Corporation, Standard Power & Light Company, Central & Southwest Utilities Company and Eastern States Power Company.

Industry Is Seeking a More Economic Grouping of Properties

On the whole, this holding company movement to date has had an economic basis, although in a few cases new plans have seemed to superimpose additional holding companies where structures already were complicated. A more economic grouping of properties is what the industry has been seeking, and the holding company in many cases has been the best instrument through which to work out such combinations. However, great combinations have been accomplished without the creation of holding companies in some instances. The Tennessee Electric Power properties were brought under the wing of the Commonwealth Power Corporation last year through an exchange of stock. On somewhat the same basis the North American Company took in its new and large California properties.

As popular interest in the common shares of power and light companies has grown a distinct trend toward stock split-ups has been apparent. Managements realize that small investors cannot afford to buy stocks that cost $150 a share. It is the common practice to split stocks into smaller pieces when the price gets beyond the reach of small investors, and chief among the companies that have followed this course recently are the American Water Works & Electric Company, Commonwealth Power Corporation, Southeastern Power & Light Company, Havana Electric Railway, Power & Light Company, National Power & Light Company and the General Gas & Electric Company.

Along with the movement toward a popularization of the equity issues has come a tendency to finance through the issuance of so-called "rights" or "warrants" which carry certain speculative features, usually in the form of a call upon stock at a given price for a given period. Sometimes these warrants are attached to bonds to make it possible for an investor to participate in the speculative movements of the stock market without actually switching his investment from the bond to the stock list. Companies that have adopted this kind of financing in one form or another are the Detroit Edison Company, Brooklyn Edison Company, Brooklyn Union Gas Company, Commonwealth Power Corporation, Public Service Corporation of New Jersey, United Light & Power Company, General Gas & Electric Company, Penn-Ohio Edison Company, Southeastern Power & Light Company and the Electric Power & Light Corporation.

Perhaps the newest wrinkle is the formation of utility investment companies which are neither operating nor holding companies but somewhat akin to investment trusts where the funds may be used to buy stocks that look cheap to the directors and sell those that look dear. Most prominent among these new companies are Electric Investors, Inc., and American Superpower Corporation, but on the same order are American States Securities, Utility Shares Corporation and the General Public Service Corporation.

Rating of Motors in Central Stations Totals 1,275,566 Hp.

THE electric motor plays a large part in the generation and distribution of electrical energy. The extent to which the motor is used in the central station plants and systems of the United States is indicated in the table below, which is based upon a survey of the industry just completed by the ELECTRICAL WORLD. There are estimated to be 91,377 motors installed in the central generating plants and in the substations of the country, with a total rating of 1,275,566 hp. Of this number, 19.5 per cent are of more than 5 hp. and 80.5 per cent are rated at 5 hp. or under. Approximately 91.9 per cent of the total rating is in motors over 5 hp. and 8.1 per cent in motors of 5 hp. and under. These figures include motors used to operate oil switches both in the generating plants and in the substations. No relation can, therefore, be drawn between the number of generating plants and the number of motors used.

The iron and steel, food, machinery and textile industries are the only primary industries which lead the central stations in the rating of motors run by energy generated in central-station plants. In number of motors the central station is led by the iron and steel, food, textiles and the paper and printing industries.

Number and Aggregate Rating of Motors Used in the Central Stations

Section	Motors in All Central Generating Plants		Motors in Central Steam-Electric Plants				Motors in Central Hydro-Electric Plants			
			Over 5 Hp.		5 Hp. and Under		Over 5 Hp.		5 Hp. and Under	
	Total Number	Aggregate Hp.	Total Number	Aggregate Hp.	Total Number	Aggregate Hp.	Total Number	Aggregate Hp.	Total Number	Aggregate Hp.
United States	91,377	1,275,566	15,227	1,098,250	53,906	80,293	2,565	73,162	19,679	23,861
New England	8,535	120,021	1,450	105,000	5,108	6,340	232	6,560	1,745	2,121
Middle Atlantic	21,676	322,533	4,025	290,000	14,265	17,685	396	11,220	2,990	3,628
South Atlantic	10,425	130,164	1,460	105,200	5,172	8,420	440	12,480	3,353	4,064
East North Central	24,947	392,941	5,010	361,500	17,710	22,000	249	7,050	1,978	2,391
West North Central	7,943	114,341	1,412	101,700	5,004	6,215	169	4,790	1,358	1,636
East South Central	3,010	34,462	373	26,900	1,326	1,651	143	4,500	1,178	1,411
West South Central	3,303	54,949	713	51,400	2,509	3,117	12	342	69	90
Mountain	4,099	37,520	277	20,000	1,010	5,270	326	9,240	2,486	3,010
Pacific	7,439	68,635	507	36,550	1,802	9,595	598	16,980	4,532	5,510

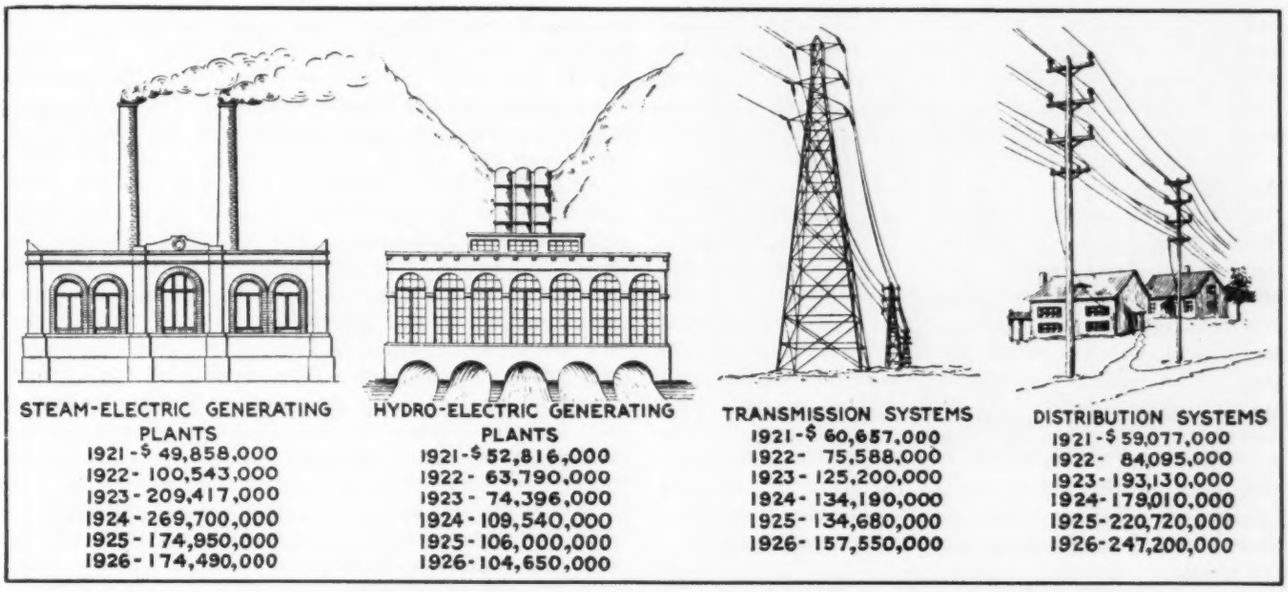
Statistics on the Operations of the Electric Light and Power Industry Based on Research Studies Made by "Electrical World" and Data Collected by the U. S. Geological Survey and U. S. Census Bureau

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926
Total energy generated (thousands of kw.-hr.)	13,000,000	14,400,000	16,175,000	21,230,000	25,438,000	29,200,000	34,900,000	39,518,903	36,970,697	43,559,677	51,132,883	54,413,403	(a) 59,517,000	(b) 63,700,000
Energy sold to lighting customers (thousands of kw.-hr.)	2,800,000	2,900,000	3,000,000	3,580,000	4,250,000	5,200,000	6,250,000	7,580,000	8,500,000	9,298,000	11,200,000	12,600,000	(a) 13,670,000	(b) 14,200,000
Energy sold to power customers (thousands of kw.-hr.)	4,400,000	5,370,000	6,055,000	9,450,000	11,878,000	13,870,000	17,310,000	19,498,903	16,730,697	20,219,677	24,290,535	25,092,873	(a) 27,867,000	(b) 30,600,000
Energy sold to electric railways (thousands of kw.-hr.)	3,300,000	3,350,000	4,000,000	4,100,000	4,400,000	4,500,000	4,600,000	4,820,000	4,600,000	5,642,000	6,000,000	6,200,530	(a) 6,460,000	(b) 6,600,000
Energy lost in transmission (thousands of kw.-hr.)	2,500,000	2,780,000	3,120,000	4,100,000	4,910,000	5,630,000	6,740,000	7,620,000	7,140,000	8,400,000	9,642,348	10,520,000	(a) 11,520,000	(b) 12,300,000
Total gross revenue (thousands of dollars)	(c) 302,273	336,980	360,000	436,000	526,894	664,850	773,650	882,750	944,400	1,072,120	1,269,550	1,354,570	(a) 1,470,000	(b) 1,570,000
Revenue from lighting customers (thousands of dollars)	(d) 271,096	.....	.....	.....	(e) 469,370	.....	.....	.....	570,500	657,120	795,000	902,670	(a) 988,000	(b) 1,055,000
Revenue from power customers (thousands of dollars)	.....	.....	.....	.....	.....	.....	.....	.....	267,800	303,200	358,150	321,000	(a) 349,000	(b) 372,000
Revenue from electric railways (thousands of dollars)	.....	.....	.....	.....	.....	.....	.....	.....	44,650	50,750	52,200	54,400	(a) 54,000	(b) 58,000
Revenue from other utilities (thousands of dollars)	(c) 31,177	.....	.....	.....	57,524	.....	.....	.....	61,450	61,050	64,200	76,500	(a) 79,000	(b) 85,000
Average retail lighting rates (cents)	8.70	8.50	8.00	8.05	8.10	7.90	7.80	8.00	7.90	7.80	7.70	7.60	7.50	(b) 7.40
Total sale of light and power securities (thousands of dollars)	.....	.....	.....	.....	.....	.....	.....	369,374	538,917	719,961	922,722	1,236,438	(h) 1,271,000	(b) 1,300,000
Sales of securities by investment houses (thousands of dollars)	.....	.....	.....	.....	.....	.....	.....	326,374	458,917	589,961	747,722	982,421	(h) 975,000	(b) 1,000,000
Sales direct to customers (thousands of dollars)	.....	.....	.....	.....	.....	.....	.....	43,000	80,000	130,000	175,000	254,017	(j) 296 000	(b) 300,000
Aggregate capitalization (thousands of dollars—Jan. 1)	2,289,622	.....	.....	.....	.....	3,245,185	3,600,000	4,100,000	4,400,000	4,800,000	5,200,000	5,800,000	6,600,000	(b) 7,500,000
Value of plant and equipment (thousands of dollars—Jan. 1)	2,175,678	.....	.....	.....	.....	3,060,392	.....	3,711,924	4,212,588	4,301,752	4,465,016	5,080,000	5,762,000	(b) 6,344,000
Number of companies generating 100,000,000 kw.-hr.	.....	.....	.....	.....	.....	5	6	9	5	6	14	14	.....	.....
Total operating expenses (thousands of dollars)	(c) 234,419	.....	.....	.....	(g) 426,568	.....	.....	(f) 440,000	(f) 432,400	(f) 481,570	(f) 576,880	(f) 617,980	(f) 659,000	(f) 705,000
Total number of operating systems (Jan. 1)	5,221	.....	.....	.....	.....	6,542	.....	.....	.....	.....	6,355	.....	.....	(b) 6,000
Total number of light and power companies (Jan. 1)	3,659	.....	.....	.....	.....	4,224	.....	.....	.....	.....	3,774	.....	.....	(b) 3,600
Total number of municipal systems (Jan. 1)	2,581	.....	.....	.....	.....	2,318	.....	.....	.....	.....	2,581	.....	.....	(b) 2,406
Total generator rating (kva.—Jan. 1)	6,400,000	6,630,000	6,970,000	7,550,000	8,520,000	11,230,000	12,330,000	13,730,000	15,860,000	16,660,000	17,960,000	21,570,000	24,410,000	26,830,000
Total number of generating plants (Jan. 1)	5,221	.....	.....	.....	.....	6,542	.....	.....	.....	.....	5,444	.....	.....	(b) 4,800
Number of light and power company plants (Jan. 1)	3,659	.....	.....	.....	.....	4,224	.....	.....	.....	.....	3,615	.....	.....	(b) 3,152
Number of municipal plants (Jan. 1)	1,562	.....	.....	.....	.....	2,318	.....	.....	.....	.....	1,829	.....	.....	(b) 1,648
Companies generating all or part of their current (Jan. 1)	4,714	.....	.....	.....	.....	5,124	.....	.....	.....	.....	4,389	.....	.....	(b) 4,190
Companies purchasing all their current (Jan. 1)	507	.....	.....	.....	.....	1,418	.....	.....	.....	.....	1,966	.....	.....	(b) 1,810
Total prime mover rating (horsepower—Jan. 1)	7,530,044	.....	.....	.....	.....	12,936,755	.....	.....	.....	.....	20,296,235	.....	.....	(b) 26,800,000
Rating of steam engines and turbines (horsepower—Jan. 1)	4,949,778	.....	.....	.....	.....	8,449,076	.....	.....	.....	.....	14,171,222	.....	.....	(b) 17,950,000
Rating of water wheels (horsepower—Jan. 1)	2,469,231	.....	.....	.....	.....	4,277,273	.....	.....	.....	.....	5,822,018	.....	.....	(b) 8,500,000
Rating of internal combustion engines (horsepower—Jan. 1)	111,035	.....	.....	.....	.....	210,406	.....	.....	.....	.....	302,995	.....	.....	(b) 350,000
Total expenditures for additions and extensions (thousands of dollars)	.....	.....	.....	.....	.....	.....	.....	.....	222,318	324,016	602,143	692,440	636,350	(i) 683,890
Total number of customers (Jan. 1)	.....	4,455,000	5,158,000	5,841,000	6,513,000	7,200,000	8,505,000	9,899,000	10,820,000	11,700,000	12,334,720	14,384,727	16,566,604	17,937,160
Total number of domestic lighting customers (Jan. 1)	.....	3,600,000	4,170,000	4,720,000	5,260,000	5,825,000	6,900,000	8,010,000	8,700,000	9,430,000	9,925,210	11,623,644	13,406,777	14,532,930
Total number of commercial lighting customers (Jan. 1)	.....	700,000	810,000	920,000	1,030,000	1,130,000	1,320,000	1,550,000	1,740,000	1,850,000	1,954,450	2,258,347	2,588,983	2,781,280
Total number of industrial power customers (Jan. 1)	.....	155,000	178,000	201,000	223,000	245,000	285,000	339,000	380,000	420,000	455,060	502,736	570,844	622,950
Number of people living in electric lighted dwellings (Jan. 1)	.....	15,600,000	18,100,000	20,450,000	22,800,000	25,250,000	29,950,000	34,700,000	37,700,000	40,800,000	43,100,000	50,300,000	58,200,000	63,100,000
Per cent of total population living in electric-lighted dwellings (Jan. 1)	.....	15.9	18.2	20.2	22.2	24.3	28.7	32.8	35.1	37.5	38.9	44.7	50.7	54.4
Total number of employees (Jan. 1)	79,335	.....	.....	.....	.....	105,541	.....	.....	.....	.....	150,762	.....	.....	(b) 194,000
Average salary of all employees (dollars)	(c) 771	.....	.....	.....	902	.....	.....	.....	.....	1,409	.....	.....	.....	.....
Average salary of officers (dollars)	(c) 1,760	.....	.....	.....	2,211	.....	.....	.....	.....	3,287	.....	.....	.....	.....
Average salary of superintendents and managers (dollars)	(c) 1,353	.....	.....	.....	1,662	.....	.....	.....	.....	2,415	.....	.....	.....	.....
Average salary of clerks (dollars)	(c) 731	.....	.....	.....	825	.....	.....	.....	.....	1,344	.....	.....	.....	.....
Average pay of wage earners (dollars)	(c) 692	.....	.....	.....	833	.....	.....	.....	.....	1,312	.....	.....	.....	.....
Total consumption of coal (short tons)	.....	.....	.....	.....	21,565,273	.....	.....	.....	.....	26,130,865	28,712,580	32,556,970	(a) 35,488,800	(b) 38,000,000
Total consumption of oil (barrels)	.....	.....	.....	.....	6,158,219	.....	.....	.....	.....	11,855,969	13,915,128	16,096,675	(a) 9,869,000	(b) 13,000,000
Total consumption of gas (thousands of cubic feet)	.....	.....	.....	.....	14,199,204	.....	.....	.....	.....	20,174,385	29,287,251	46,993,070	(a) 47, 313,400	(b) 48,000,000
Length of transmission lines (circuit miles—Jan. 1)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	86,290	94,880	102,270	(b) 109,170
Length of distribution lines (circuit miles—Jan. 1)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	354,780	383,780	416,670	(b) 451,990
Developed water power (U.S. Geological Survey—horsepower) (March 1)	.....	.....	.....	.....	.....	.....	.....	.....	7,926,958	.....	.....	9,086,958	10,037,655	(b) 11,000,000

(a) — Estimated based on ten months' operations.
(b)—Estimated, based on past growth.
(c)—1912, United States Census Bureau.
(d)—1912, includes all revenue except from other utilities.
(e)—Includes all income except from other utilities.
(f)—Does not include interest, taxes, depreciation or sinking fund.
(g)—United States Census Bureau.
(h)—Last week of December estimated.
(i)—Does not include $50,460,000 spent for administrative quarters, warehouses, etc..
(j)—November and December estimated.

$734,350,000 for Construction in 1926

Central-Station Expenditures for New Equipment Will Exceed 1925 Budget by $50,000,000—Many Notable Steam and Hydro Projects Under Way



MORE MONEY WILL BE SPENT FOR EXTENSIONS TO THE DISTRIBUTION SYSTEMS DURING 1926 THAN WAS SPENT FOR ALL CONSTRUCTION PURPOSES IN 1921

CENTRAL-STATION construction budgets for the year 1926 should total $734,350,000, in accordance with the reports received by the ELECTRICAL WORLD from companies spending or controlling the expenditures of about two-thirds of the total outlay of the industry. Of this amount $174,490,000, or 23.8 per cent, will be expended for additions and extensions to steam-electric plants; $104,650,000, or 14.3 per cent, for hydro-electric plants; $157,550,000, or 21.4 per cent, for transmission systems; $247,200,000, or 33.6 per cent, for distribution systems; and $50,460,000, or 6.9 per cent, for new administrative quarters, warehouses, garages, etc. This is the first year that data have been gathered on the amount to be spent for new administrative quarters and other miscellaneous purposes necessary to the operations of the industry. It must be remembered, therefore, in comparing the total figure with similar ELECTRICAL WORLD data for previous years that supplementary expenditures were not included in the data issued for other years.

These construction figures are based upon preliminary budgets in many cases. A large number of the companies reporting their 1926 construction budgets to the ELECTRICAL WORLD were forced to report estimates, since the full budget will not be completed and approved until after the first of the year. Later in the year

Table II—Segregation of Central-Station Construction Budget Between Generation and Transmission

Year	Total Central Station Construction Budgets for Year	Total Expenditures for Electric Generating Plants	Total Expenditures for Transmission and Distributing Systems	Per Cent of Total Spent on Generating Plants	Per Cent of Total Spent on Transmission and Distribution Systems
1921....	$222,408,000	$102,674,000	$119,734,000	46.2	53.8
1922....	324,016,000	164,333,000	159,683,000	50.8	49.2
1923....	602,143,000	283,813,000	318,330,000	47.1	52.9
1924....	692,440,000	379,240,000	313,200,000	54.8	45.2
1925....	636,350,000	280,950,000	355,400,000	44.2	55.8
1926....	683,890,000	279,140,000	404,750,000	40.8	59.2

Table I—Total Value of All Additions and Extensions to Central-Station Generating and Distributing Systems from 1921 to 1926

Section	1921*	1922*	1923*	1924*	1925*	1926	
						Generation and Distribution	Miscellaneous†
Eastern States	$43,136,000	$101,525,000	$211,196,000	$259,850,000	$194,740,000	$201,500,000	$20,000,000
Southern States	29,341,000	49,805,000	82,105,000	104,460,000	100,550,000	122,840,000	6,040,000
North Central States	67,900,000	96,700,000	206,180,000	218,950,000	214,450,000	206,100,000	20,200,000
Western States	82,031,000	75,986,000	102,662,000	109,180,000	126,610,000	153,450,000	4,220,000
Totals	$222,408,000	$324,016,000	$602,143,000	$692,440,000	$636,350,000	$683,890,000	$50,460,000

* Does not include "miscellaneous expenditures." † Administrative quarters, warehouses, etc.

Table III—Value of Additions and Extensions to Generating Plants from 1922 to 1926

Section	Fuel Electric Generating Plants — Value of Proposed Additions					Hydro-Electric Generating Plants — Value of Proposed Additions				
	1922	1923	1924	1925	1926	1922	1923	1924	1925	1926
Eastern States	$47,120,000	$73,070,000	$94,900,000	$78,320,000	$66,250,000	$10,930,000	$15,926,000	$41,760,000	$10,550,000	$14,100,000
Southern States	13,350,000	24,155,000	34,200,000	7,680,000	11,240,000	16,900,000	14,490,000	22,600,000	27,700,000	30,400,000
North Central States	34,700,000	107,900,000	127,500,000	70,500,000	71,800,000	9,800,000	5,180,000	7,200,000	11,950,000	3,400,000
Western States	5,373,000	4,292,000	13,100,000	18,450,000	25,200,000	26,160,000	38,800,000	37,980,000	55,800,000	56,750,000
Totals for U. S.	$100,543,000	$209,417,000	$269,700,000	$174,950,000	$174,490,000	$63,790,000	$74,396,000	$109,540,000	$106,000,000	$104,650,000

additional figures will be given in these columns based upon the final and approved construction budgets of the industry. The figures in the accompanying tables, however, are believed to indicate very clearly the probable construction budgets of the industry during 1926.

The outstanding fact to be drawn from these construction figures is the record amount that will be spent for additions and extensions to the transmission and distribution systems of the country. Almost $405,000,000, or 59.2 per cent, of the total expenditures for electrical equipment will be on transmission and distribution systems, as against 40.8 per cent on generating plants. This trend in segregation of the nation's construction budget as between generation and distribution was first noted in the 1925 budget. At that time 44.2 per cent of the total budget was for generating equipment and 55.8 per cent for transmission and distribution. With 1926, therefore, the trend is still more intensified. The two inferences to be drawn from these facts are that the record additions made to the generating plants during 1923 and 1924, 6,450,000 kva., together with the additions during 1925, 2,420,000 kva., or 8,870,000 kva. for the three years, have been sufficient to take care of a large portion of the new load expected during 1926. Also, through interconnection and mergers of company systems, which reached record proportions during 1925, the industry has arrived at the point where, through the operations of the superpower type of systems, additional power is available that calls for increased attention to the distribution of that power to the ultimate consumer.

Another interesting fact is that, as indicated elsewhere in this issue, the number of new residential customers taken on the lines during 1925 was materially less than the number added during 1924, yet the expenditures for distribution equipment during 1925 were about $41,000,000 more than those reported for 1924, and will be further increased during 1926. The explanation probably lies in the cycle of central-station construction activities that has been established during the past few years. The distribution activities of the industry are passing through very much the same portion of the construction cycle as was experienced during 1922 and 1923, when the budget for new distribution equipment was almost quadrupled, increasing from $59,000,000 in 1922 to $193,000,000 in 1924. The opening of 1922 found hundreds of large residential building plots throughout the country opened up for development calling for the immediate extension of the distribution systems of the central-station companies serving these territories. These extensions took care of the 1923 and 1924 new residential construction to a very large extent, as was indicated by the fact that although the record number of 1,783,000 new residential customers were taken on the lines during 1924, the amount spent for extensions to the distribution systems was 7.3 per cent less than that spent in 1923, when fewer customers were taken on the lines. The summer of 1925 found a large portion of these old plots completely developed, and again hundreds of new plots were opened up, calling for the same abnormal increase in distribution equipment, which will evidently continue into 1926. If this cycle is continued as in the past, the expenditures for distribution equipment during 1927 will be very materially less than those of 1926, this tendency being intensified by the passing of the housing shortage throughout the country.

The amounts to be spent on the generating plants during 1926 in the country as a whole appear to be about the same as the amounts spent during 1925, this condition applying to both steam and hydro plants. A detailed discussion of the plants under construction will be found elsewhere in this issue. The South and the West will materially increase their steam equipment during the year, thereby reflecting the lessons gained from the serious water shortage experienced in the South during 1925 and in the West during 1924. The completion during the past year of several large steam-electric plants in the New England and Middle Atlantic States is reflected in a 15.5 per cent drop in the volume of new steam plant equipment in this section during 1926.

From the reports received it is estimated that about 6.9 per cent of the total expenditures during the year will be for miscellaneous purposes, including administrative buildings, warehouses, etc. A large number of companies reported no extensions of this nature during 1926.

Table IV—Value of Additions and Extensions to Transmission and Distributing Systems from 1922 to 1926

Section	Transmission Systems — Value of Proposed Additions					Distributing Systems — Value of Proposed Additions				
	1922	1923	1924	1925	1926	1922	1923	1924	1925	1926
Eastern States	$22,700,000	$37,880,000	$37,070,000	$31,320,000	$37,650,000	$20,775,000	$84,320,000	$86,120,000	$74,550,000	$83,500,000
Southern States	9,290,000	21,890,000	33,400,000	30,700,000	42,800,000	10,265,000	21,570,000	14,260,000	34,470,000	38,400,000
North Central States	22,000,000	44,800,000	43,930,000	57,000,000	47,800,000	30,200,000	48,300,000	40,320,000	75,000,000	83,100,000
Western States	21,598,000	20,630,000	19,790,000	15,660,000	29,300,000	22,855,000	38,940,000	38,310,000	36,700,000	42,200,000
Totals for U. S.	$75,588,000	$125,200,000	$134,190,000	$134,680,000	$157,550,000	$84,095,000	$193,130,000	$179,010,000	$220,720,000	$247,200,000

Public Relations

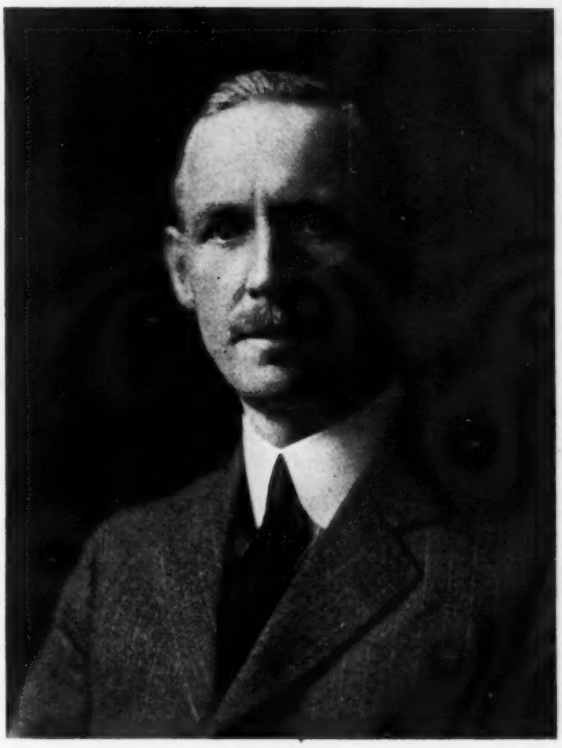
Whose Problem and How Solved?

Cordial Relations Are Not Developed by Superficial Practices or National Resolutions—Securing of Good Will Is an Individual Problem for Each Company in Which All Employees Must Co-operate

An Interview with

R. F. PACK

First Vice-President N.E.L.A. and Vice-President and General Manager Northern States Power Company



R. F. PACK

ALTHOUGH the purposes of public relations work have been highly desirable, the results have not always been what they should be, because of improper analysis of the problem and execution of the work. The trouble has apparently been that the fundamentals of cordial human relations have been overlooked. To stimulate some new lines of thought and action which will bring substantial permanent results, the views of R. F. Pack, first vice-president of the N.E.L.A. and vice-president and general manager of the Northern States Power Company, have been solicited and are presented here. Mr. Pack says:

"The ultimate objective of 'public relations' activities is obviously to further the growth of business through the establishment of cordial, sincere and sympathetic relations between a public service corporation and the public it serves.

"There is a very fundamental reason why a utility company operating as a monopoly has a tendency to become unpopular. If a person desires to purchase a pair of shoes or some food supplies, there are a number of stores into which he can go. If the treatment accorded is not satisfactory at one place, the purchaser simply walks out and goes to another.

"When it comes to buying electric current, the purchaser feels that there is only one place to which he can go and before he enters the office building he feels under some compulsion, which often is irksome to him. If upon entering the door he meets with a chilly reception or is discourteously treated or is faced with a lot of needless rules and regulations, he feels that the company is taking advantage of him because he cannot go elsewhere. Consequently before he has even begun to establish business relations his feeling easily may be one of resentment toward the company. This feeling is further accentuated after he is a customer if, for instance, the meter reader tracks mud in his house on a rainy day, or if he is given a discourteous answer over the telephone, or if the cashier receiving payment of his account snatches the money or check from him without a smile and a 'thank you.'

"Finally, these apparently small irritations grow in the customer's mind to a point where he feels a distinct antagonism toward the company. Although he cannot definitely state the reason for this feeling, he concludes that it must be because the rates are too high and he is then in a mood to join with others to commence a rate agitation. It rarely happens that rates in themselves are the primary cause of the trouble; it is these petty irritations constantly repeated and which, therefore, must be so carefully guarded against.

How Impressions Are Formed

"A public service corporation has a personality quite as distinct as that of an individual. This personality usually is the composite personality of the more prominent officials of the organization, expressed as this must be through all the employees who come into contact with the public. For this reason it is quite possible definitely to change the personality of a corporation, thus giving it a decided advantage over the individual, whose characteristics have often become set and unalterable.

"People form their impressions of public utility organizations much as they form their impressions of individuals. We all know prominent individuals in our respective communities who are both respected and popular. We know of individuals of similar prominence who are neither respected nor popular. One occupies his enviable position because he has lived rightly, has been honest in his business dealings and courteous to and considerate of his fellow human beings with whom he comes in daily contact. The other has failed to achieve either respect or popularity because he has lacked these qualities.

"What would we think of the latter citizen if he occasionally rented a hall and often passed out circulars and advertised in the papers to inform the public that he was a very respectable citizen of high integrity,

that he had no intention to defraud any one and that even widows and orphans could trust him implicitly? Would we not say, 'Methinks he doth protest too much,' and be somewhat fearful of putting undue confidence in his statements and actions? Is not our belief in the high-mindedness of the average citizen built up through the intangible influences that emanate from him over a long period of time? De we not draw very positive and, in the vast majority of cases, most accurate conclusions as to the character of most of our citizens in just exactly this way?

"It is equally foolish for the average public service corporation to expect to obtain the confidence of the public by constantly advertising its merits and by asserting its desire to please. The public will not be convinced by the written word, but will unquestionably have formed its very clear-cut opinions from the past actions and general behavior of the corporation.

PUT HOUSES IN ORDER

"It is of little use for the companies that have failed to obtain the public good will to meet at some central point and pass resolutions or to engage in national advertising, expecting that these activities will instantly change public opinion in respect to the public service corporations of the country, because the public does not like or dislike these corporations as a whole any more than it likes or dislikes citizens in masses. Each community will decide for itself, and usually rightly, whether the corporation that serves it is or is not worthy of its confidence and respect.

"Some who read this will say that the electric utility companies of this country realized all this years ago, and that corrective methods long since have been applied. I am thoroughly aware that all this has been brought to the attention of the industry; that we have talked about it, not once but hundreds of times; that we have passed resolutions, and devised better methods. But I am quite convinced that all of us have not succeeded in placing our respective houses in order and that today the real public relations problem lies with each individual company in its own community.

"Let us consider another citizen approaching the office of his monopolistic electric utility. He, too, feels that he is compelled to deal with this one company; that something is going to be 'put over on him'; that at the very least he will be insulted by some autocratic clerk. He is thoroughly warned and prepared to protect his rights. He enters the building with his armor on, but instead of encountering an atmosphere of hostility and indifference he steps into an atmosphere of friendliness and consideration.

"The moment he enters the door a neat young woman at the information desk smilingly wishes him good morning and asks if she can be of assistance. He is directed, not to a barred window, but to a desk where he takes a seat and states his business. There is no red tape. He is not sent from one autocratic clerk to another; his credit is not reflected on. The customer's and the company's necessary business is pleasantly transacted and he is given the distinct impression that the company appreciates his patronage and that his needs are being taken care of with all possible dispatch. Instead of insult and indifference, he has found courtesy and consideration, and he leaves the building a potential friend of the company.

"This first favorable impression, however, must be sustained and constantly repeated in all future experiences and contacts with the company. The men making the service connection must be trained to have due consideration for the customer's property; the meter reader must wipe his boots; the service man must be ready to handle trouble calls with a degree of celerity and a measure of courtesy which again will impress the customer with the company's determination to give the best service that human beings can devise.

"When I say that rate agitations rarely are caused by rates themselves, provided these are reasonable, and most generally they are, and when I say that proper personal contacts between employees and customers turn enemies into friends, I am not stating theories, but facts gleaned from actual experiences. Personally I have had many opportunities to analyze rate agitations in our own company and in other companies. I know of one instance where a couple of indifferent clerks turned a city against an electric company.

"There may grow up an unconscious impression in a utility organization that only those in a public relations department need interest themselves in public relations. This indicates the necessity of impressing every employee with the conviction that every man and woman in the company must be an active member of the department of public relations and that they must not assume, because of the existence of such a department, that they can insult a customer and leave it to that department to straighten it out. Indeed, the entire personnel of the company constitutes the public relations department. It is my belief that the companies are better off without a distinct and separate department known as a public relations department.

"No department of public relations can function successfully unless the entire organization is functioning with it. It must start with a manager who has imbued in his system the spirit of fair dealing, courtesy and service three hundred and sixty-five days in the year, and he must see to it that that spirit reaches every single employee of the company, men and women alike.

"With such an organization, I think the major portion of our public relations problem is solved, for I do not believe that the American people as a whole are in favor of any radical program affecting the public service corporations of this country.

EVERYTHING TO LOSE, NOTHING TO GAIN

"So far as the great majority of the people are concerned, I believe that they listen to the cry of the agitator only when they have been exposed to frequent irritating contacts with their local utility organizations.

"True, we have spasmodic attempts to make effective radical programs—North Dakota is a recent instance—but in two or three years the logic of events and the economics of the situation cause these radical policies to die down. Do not forget that radical policies involving government ownership cannot be made effective in this country without the vote of the farmer and of labor being pretty generally cast in their favor. Why should the artisan wish to change the present system? He has only to look to Russia, where communistic ownership was carried to the extreme, or even to other European countries, where public ownership has been tried on a more restricted scale, and to compare his lot with that of the workman of Europe. The inevitable result is that he will appreciate that he has everything to lose and nothing to gain by advocating a change.

"In how many countries do you suppose the average

workingman has a telephone or even electric light in his home, to say nothing of owning an automobile? When he compares his social standard and scale of living with that of workingmen in any other country in the world, he will not be such a fool as to wish to lose all he has obtained and get nothing in return.

"Why should the farmer favor any socialistic measure, knowing as he does that all wealth ultimately comes from the land and if any general tendency toward socialism be followed it must inevitably lead to state ownership of the land?

"We are all too apt to think of labor and the farmer in the mass and to forget that these groups consist of individuals who do their own thinking and are just as keen observers as any other class of citizens.

"Chronic agitators are always with us. They are divided into several classes. Some are mentally dishonest politicians seeking to attract votes; some conscientiously believe in their theories and some there are who talk just for the sake of talking. Probably the best way to rob the vote seeker of his effectiveness is to make our companies popular with their customers. You will find that this type of politician has his ear to the ground. He is not going to waste his time attacking an institution that is popular. He knows he will get a quicker response from the voters by attacking something that is unpopular. This suggests once more the necessity for doing our public relations work among our own customers.

"I do not wish to be misunderstood as attributing dishonest motives to all those who misrepresent or attack our companies. I am convinced that there are some very honest men and women in this country who believe that the present system of operating public service corporations is not in the best interest of the citizens. Such men and women, however, can usually be reasoned with. If a well-informed member of the company's organization will take the necessary time and use ordinary tact and courtesy in stating facts, more often than not such individuals can be convinced that the company is trying to do the right thing and that indeed the financial and engineering structures and operating policies upon which our companies are based are not far from being right after all.

"Too often the average official of our companies is apt to feel a personal grudge against the individual who does not see eye to eye with him in regard to the business of his company. This is a very great mistake. The company officials should include among their acquaintances, and better still among their friends, those who honestly differ from them, as friendly discussion tends to broaden the minds of both disputants.

"Recently we have been hearing about holding companies, but these institutions so obviously justify themselves that I am inclined to think we have wasted some time and effort in an attempt to defend them. The public is aware that these companies are a necessary instrument to provide a wider distribution of electric service and to enable this to be rendered more efficiently and economically and that the very laws themselves in some states compel the existence of such holding companies.

"The acquisition of smaller and inefficient systems by larger companies and their interconnection through transmission systems often requires the operation of many small companies by a parent company, and in the process of assimilation a holding company is very necessary.

"Finally, and perhaps principally, holding companies, which as management and engineering companies control and operate their constituent and subsidiary companies, have been the means of bringing service to many small rural communities and villages with rates very little higher than those charged in the congested centers of population. They have made possible the decentralization of industry and placed the small town in as favorable a position to obtain large industrial plants as the big city.

"In conclusion, what is a practical method to achieve the results we all so much desire?

"First, good service at reasonable rates rendered courteously by each local company with a well-informed personnel, each element of which is a 'public relations' department in itself, and the development of customer ownership.

"Second, friendly intercourse with all classes of citizens regardless of their convictions, if these are honestly maintained.

"Third, enlarge the scope and activities of the

Some High Points

Natural monopoly accompanied by chilly attitude and small irritations develop public antagonism.

Securing of good will is an individual problem, not a national one to be handled by national organization.

"Put houses in order" by substituting friendly atmosphere for indifferent or hostile one and by eliminating small irritating practices.

Corporation personality is judged the same as individual personality, but represents a composite of many personalities.

Create favorable first impression and sustain it by all subsequent actions.

Actions and attitude, not resolutions, produce results; one indifferent employee can antagonize an entire community.

Service and courtesy convert opponents to friends.

Forget the masses and think of individuals.

Include among your friends persons who have radically opposite views.

Popular institutions discourage political attack; sincere agitators are open to reason.

Happy utility employees have wider influence on public attitude than advertising.

Every individual employee influences public opinion; public relations department alone can accomplish nothing.

geographic divisions of the National Electric Light Association. They should represent the better spirit of the local companies. Let them become the clearing houses of information and advice throughout the districts in which they operate. Let them accept more responsibility and do more seriously and actively the work intrusted to them.

"Fourth, let the executive committee of the N.E.L.A. in turn catch the spirit of the geographic divisions and let the representatives of these divisions have a more prominent part in formulating the national policies of the association.

"There is some danger of too much centralization of N.E.L.A. activities and the orderly processes outlined above show signs of being completely reversed with the menacing possibility that the local companies will more and more 'let George do it' and feel that all is well if only the N.E.L.A. headquarters will keep busy and do in some national way what should be done first, last and all the time by the local company in each community.

"Good 'public relations' are like Christianity, a matter of personal contact. No laws and no resolutions have ever made a good Christian, and exactly in the same way, one by one, the citizens of this country must be reached, informed, fairly treated and their confidence gained by good service rendered with a courteous regard for their undeniable rights and with a proper sense of the obligations the companies owe those whom they serve."

Record Trend to Centralized Management

Mergers During 1925 Involved 560 Companies—Capitalization of Acquired Companies Totaled $1,957,263,000—Many Very Large Holdings Involved

CENTRALIZED management, power pooling, interconnection and co-ordinated development of power resources received much attention during the year just closed. This is reflected in the record number of mergers consummated during the year as listed below. A total of 560 companies were involved in these mergers, of which 153 were absorbing companies and 407 were acquired companies. The great importance of these mergers is brought out by the fact that the capitalization of the 407 acquired companies totaled approximately $1,957,263,000, or about one-quarter of the aggregate capitalization of the electric light and power industry. Due to the fact that some of these companies were involved in two or more mergers during the year, the capitalization cannot be taken as the net capitalization of the 407 companies.

The capital involved in some of the mergers brings out the great strides made in centralized management during the year. One merger involved acquired properties and an administration company with a total capitalization of more than two hundred and eight million dollars, and in three other cases the capitalization of the absorbed companies totaled between one hundred and twenty-five million and one hundred and seventy-five million dollars. There were twenty-one absorptions involving a capitalization of more than twenty-five million dollars each.

The companies acquired were not confined to any one section of the nation, and in many instances the acquired companies operated in several states and even in widely separated sections of the country.

The accompanying tabulation is believed to include all operating and administration companies involved in mergers during the year, except where the transactions were of such small proportions as not to be reported to the ELECTRICAL WORLD.

Mergers of Central Station Systems During 1925

Companies Involved	Territory Served	Capitalization	Date of Merger
Adirondack Light & Power Co.: Warrensburgh Electric Lt. Wks.	Warrensburgh, N.Y., and vicinity	†$32,000	*May
Bolton Light and Power Co.	Bolton Landing, N.Y. and vicinity	$25,000	*May
Alabama Power Co.: Andalusia Light & Power Co.	Andalusia, Ala.	$15,000	*June
Sheffield Co.	Sheffield, Ala., and vicinity	$700,000	May
Birmingham, Montgomery & Gulf Power Co.	Alabama	.....	*June
Alexandria Light & Power Co.: Fairfax & Loudoun Light & Power Co.	Northern Virginia	$1,000,000	*Mar.
American Gas & Electric Co.: Virginian Power Co.	Charleston, W. Va., and vicinity	$15,000,000	Feb.
Appalachian Power Co.	Virginia and West Virginia	$32,693,308	Feb.
American Power & Light Co.: Northwestern Electric Co.	Portland, Ore., Vancouver, Wash., and vicinity	$24,834,482	Feb.
Bend Water Light & Power Co.	Bend, Ore.	$758,047	*May
Superior Water, Lt. & Power Co.	Superior, Wis., and vicinity	$4,862,395	*Aug.
Appalachian Power Co.: Rocky Mount Light & Power Co.	Rocky Mount, Va.	$20,000	*Oct.
Associated Gas & Electric Co.: Ridgefield Electric Co.	Ridgefield, Conn., and vicinity	$40,000	*Feb.
Depew & Lancaster Light, Power & Conduit Co.	Outskirts of Buffalo, N. Y.	$3,515,984	*Apr.
Pennsylvania Electric Corp.	Pennsylvania and Maryland	$88,137,772	*Aug.
Litchfield Elec. Lt. & Pwr. Co.	Litchfield, Conn., and vicinity	$279,258	*Aug.
Iroquois Utilities Co.	Western, New York.	†$256,000	*Mar.
Champlain Electric Co.	Champlain, N. Y.	†$84,000	June
N. Y.-Vt. Interstate Power Co.	Eastern New York and Vermont	.....	June
Harlem Valley Electric Corp.	Pawling, N. Y., and vicinity	$150,000	June
Bangor Hydro Electric Co.: Bangor Railway & Electric Co. / Bangor Power Co. / Bar Habor & Union River Power Co. / Lincoln Light & Power Co.	Bangor, Bar Harbor, Me, and vicinity	$11,253,232	Feb.
Binghamton Lt. Heat & Pwr. Co.: Afton-Windsor L. H. & P. Co.	Central New York	$199,359	July
Broad River Power Co.: Batesburg, S. C., Municipal.	Batesburg, S. C.	$137,500	*Jan.
Lexington Elec. Lt. & Pwr. Co.	Lexington, S. C.	$10,000	*Feb.
B. J. Day, Jr., Property in Trenton	Trenton, S. C.	.....	June
Johnston Light & Ice Plant	Johnston, S. C.	$84,000	June

*Date reported in ELECTRICAL WORLD. †Estimated.

Mergers of Central-Station Systems During 1925 (Continued)

Companies Involved	Territory Served	Capitalization	Date of Merger
Columbia Gas & Elec. Co.... Parr Shoal Power Co.....	Columbia, S. C., and vicinity.....	$13,595,774	July
South Carolina Power Co.....	.....	.....	July
Central Carolina Power Co.....	.....	.....	July
Public Service Co. of S. Carolina.....	.....	.....	July
Buffalo, Niagara & Eastern Co.:			
Niagara Falls Power Co.....	Western New York.	$84,300,564	*May
Niagara, Lockport & Ontario Power Co.....	Western New York.	$40,212,553	*May
Tonawanda Power Co.....	Western New York.	$1,858,145	*May
Buffalo General Electric Co.....	Buffalo, New York and vicinity.....	$37,138,824	*May
H. M. Byllesby & Co.:			
Coast Power Co.....	Tillamook, Ore., and vicinity.....	$456,438	*Jan.
Douglas Light & Power Co.....	Douglas, Wyo.....	$100,000	*July
Falls City, Ore., Municipal.....	Falls City, Ore.....	†$19,000	*July
Wisconsin Public Service Corp..	Wisconsin and Mich.	$20,042,947	*July
Consumers Light & Power Co..	Ardmore, Okla. and vicinity.....	$2,000,000	*Aug.
California-Oregon Power Co....	Southern Oregon and Northern Calif...	$19,347,682	*Nov.
Libby Water & Electric Co.....	Libby, Mont.....	†$131,000	*Nov.
Calumet Gas & Electric Co.:			
Indiana Electric Utilities Co....	Angola, Ind., and vicinity.....	$386,400	Feb.
Calumet Power Co.....	Indiana.....	$1,146,861	July
Carolina Power & Light Co.:			
North State Power Co.....	Wake, Harnett and Johnston Counties, N. C.....	$207,000	*Feb.
Catskill Power Corp.:			
Rockland Light & Power Corp... (Hydro-Electric Property)	Rockland County, N.Y. and vicinity.	$11,448,105	*July
Central and Southwest Utilities Co.:			
American Public Service Co...	Texas, Oklahoma, Louisiana, Arkansas, Kansas and Mississippi...	$23,447,056	*Sept.
Public Service Co. of Okla.....		$9,129,858	*Sept.
Chickasha Gas & Electric Co..		$1,925,488	*Sept.
Central Power & Light Co.....		$21,457,273	*Sept.
Southwestern Securities Co...		.....	*Sept.
Central Illinois Public Service Co.:			
Alvin Grain & Electric Co.....	Alvin, Ill., and vicinity	$17,000	*Dec.
Galatia Municipal.....	Galatia, Ill.....	.....	*June
Thebes Municipal.....	Thebes, Ill.....	.....	*June
Wabash Utilities Co.....	Lawrence and Crawford Counties, Ill.	.....	*Dec.
Marshall Ice & Power Co.....	Marshall and Martinsville, Ill.....	$52,000	*Dec.
Central Iowa Power & Light Co:			
Grundy Center Electric Co.....	Grundy Center and Holland, Ia.....	$95,000	*Feb.
Cherokee Electric Co.....	Cherokee, Ia. and vicinity.....	$117,000	*June
Gilmore City Electric Co.....	Gilmore City, Iowa.	.....	*June
Central Maine Power Co.:			
Bethel Light Co.....	Bethel, Me., and vicinity.....	$18,000	*June
Central Missouri Power & Light Co.:			
Moverly Light & Power Co.....	Moverly, Mo.....	$559,000	*June
Huntsville Light & Power Co....	Huntsville, Mo.....	$25,000	*June
La Plata Light, Heat & Ice Co..	La Plata, Mo.....	$25,000	*June
Citizens Electric Co.....	Higbie, Mo.....	$5,000	*June
Boonville Lt. Heat & Pwr. Co....	Boonville, Mo.....	$75,000	*June
Central Public Service Co.:			
West Bend Heating & Lighting Co.....	Wisconsin.....	$200,000	*Aug.
Central States Power & Light Corp.:			
Northeastern Iowa Power Co....	Northeastern Iowa,	$4,977,351	*July
Nebraska Electric Power Co..	Iowa, Nebraska, Missouri, North Dakota and Arkansas	.....	*July
Central Lt. &Pwr. Co. (N. D.)		$150,000	*July
Arkansas Public Service Co...		.....	*July
Hawkeye State Power Co....		.....	*July
Southeast Missouri Public Service Co.....		.....	*July
Missouri Electric Power Co...		.....	*July
Missouri Power & Development Co.....		.....	*July
Floresville Light & Power Co...	Floresville, Tex.....	$25,000	*Oct.
Burnet Light & Power Co.....	Burnet, Tex.....	.....	*Oct.
Bertram Light & Power Co.....	Bertram, Tex.....	$275,000	*Oct.
Properties in Round Rock, Hutto, Buda, Kyle, Stockdale and Flugerville.....	Texas.....	.....	*Oct.
		.....	*Oct.
Champlain Electric Co.:			
Champlain Electric Co.....	Northeastern New York	$22,500	June
Plattsburgh Gas & Electric Co.		$585,000	June
Chasm Power Co.....		$99,000	June
Boquet Electric Power Co....		$34,000	June
Chickasha Gas & Electric Co.:			
Carnegie Water Power Co.....	Cargegie, Okla., and vicinity.....	†$96,000	*Nov.
Citizens Light & Power Co.:			
Consumers Elec. Lt. & Pwr. Co..	New Orleans, La....	$3,385,000	*Oct.
Columbia Gas & Electric Co.:			
Dayton Power & Light Co.....	Dayton, Ohio and vicinity.....	$26,625,157	Feb.
Columbus Electric & Power Co:			
Gerogia-Alabama Power Co...	Albany, Ga., and vicinity.....	$2,595,000	*Aug.
South Georgia Pub. Serv. Co.		$243,000	*Aug.
Commonwealth Power Co.:			
Tennessee Electric Power Co....	Tennessee.....	$65,059,566	June
Consumers Power Co.:			
R. J. Tower Electric Co.....	Greenville, Mich....	$300,000	*June
Consumers Public Service Corp. of Delaware.:			
Wood River Power Co.....	Hailey, Idaho and vicinity.....	$460,853	*Aug.
Prof. Arthur S. Dewing:			
Salem Electric Co.....	Salem, N. H.....	$51,000	*Dec.
Des Moines Electric Co.:			
Properties of Hall Electric Co. at Altoona and Mitchellville, Ia.	Altoona and Mitchellville, Iowa.....	.....	*Dec.
H. L. Doherty & Co.:			
Lawrence County Water, Light & Cold Storage Co.....	Aurora, Mo., and vicinity.....	$718,339	July
East Texas Public Service Co.:			
Waskom Light & Power Co....	Waskom, Tex.....	.....	*Oct.
Eastern Seaboard Power Corp.:			
Long Island Lighting Co.....	Long Island.....	$15,000,000	*Nov.
East Hampton Electric Light Co.	Long Island.....		*Nov.
Eastern States Utility Co.:			
Fayetteville, Light & Power Co..	Fayetteville, N.C...	$150,000	*Sept.
Eastern Texas Electric Co.:			
Western Public Service Co....	Wyoming, Colorado, Nebraska, Missouri, Iowa, and Texas.....	$7,527,427	*Sept.
Electric Power & Light Corp.:			
Arkansas Light and Power Co..	Pine Bluff, Ark., and vicinity.....		Mar.
Dallas Power & Light Co.....	Dallas, Tex.....		Mar.
Dallas Railway Co.....	Dallas, Tex.....		Mar.
Louisiana Power Co.....	Louisiana.....		Mar.
Louisiana Power & Light Co....	Lousiana.....		Mar.
Mississippi Pwr. & Light Co....	Jackson, Miss., and vicinity.....	$71,983,220	Mar.
New Orleans Public Service Inc..	New Orleans, La....		Mar.
Power Securities Corp.....	Idaho and Nevada..		Mar.
Southern Pwr. & Lt. Co. of Md....			Sept.
Texas Interurban Rwy.....			Mar.
Utah Power & Light Co.....	Utah.....		Mar.
Empire Power Corp.:			
New York Central Elec. Corp....	Central New York...	$6,332,122	Jan.
Engineers Public Service Co.:			
Virginia Railway & Power Co...	Virginia.....	$60,201,573	June
Spotsylvania Power Co.....	Fredericksburg, Va..	$1,420,644	June
Key West Electric Co.....	Key West, Fla.....	$1,894,061	Dec.
Exeter Hampton Elec. Co.:			
Plaistow Elec. Light & Power Co.	Plaistow, N. H.....	.....	*Dec.
First Wisconsin Trust Co.:			
Antigo Electric Co.....	Antigo, Wis.....	$306,766	*Aug.
W. B. Foshay Co.:			
Peoples Light & Power Co.....	Fulda, Minn., and vicinity.....	$758,686	*Jan.
Gasconade Power Co.:			
Bland Municipal.....	Bland, Mo.....	$11,000	*Aug.
Owensville Municipal.....	Owensville, Mo.....	$25,000	*Aug.
General Gas & Electric Co.:			
Towanda Gas & Electric Co.....	Towanda, Pa., and vicinity.....	†$320,000	*Aug.
Northern Pennsylvania Pwr. Co	Northern Pennsylvania.....	$249,758	*Aug.
Saylorsburg Light & Power Co..	Monroe County, Pa.	†$14,000	*Nov.
Georgia Alabama Power Co.:			
Meigs Municipal.....	Meigs, Ga.....	$50,000	*Aug.
Georgia Hydro Electric Co.:			
Towaliga Falls Power Co.....	Griffin, Ga.....	$470,000	Feb.
General Power & Light Co.:			
Calhoun Public Service Co.....	Western Kentucky..	†$24,000	*Nov.
Sebree Power & Light Co.....	Western Kentucky..	†$25,000	*Nov.
Slaughters Electric Light Co....	Western Kentucky..	.....	*Nov.
Corydon Light & Power Co.....	Western Kentucky..	.....	*Nov.
Georgia Southern Power Co.:			
Dublin Municipal.....	Dublin, Ga.....	†$316,000	*Oct.
Gulf States Utilities Co.:			
Orange Municipal.....	Orange, Tex.....	$100,000	*Sept.
Halifax Power Co.:			
Emporia Hydro Elec. Pwr. Corp.	Virginia.....	$185,000	*Sept.
Chase City Municipal.....	Virginia.....	†$64,000	*Sept.
Victoria Ice, Light & Power Co. plants at Brookneal and Blackstone.....	Virginia.....	.....	*Sept.
Harlem Valley Electric Corp.:			
Harlem Valley Elec. Corp.....	New York.....	$150,000	June
Morgan & Wyman Elec. Light & Power Co.....	New York.....	†$34,000	June
Amenia Electric Lt. & Pwr. Co..	New York.....	†$35,000	June
Katonah Lighting Co.....	New York.....	$167,000	June
Ridgefield Electric Co.....	Ridgefield, Conn....	$45,000	June
Croton Falls Lighting Corp.....	New York.....	$144,000	June
Cold Spring Light, Heat & Power Co.....	New York.....	$15,200	June
Chatham Electric Light, Heat & Power Co.....	New York.....	$50,000	June
Lebanon Valley Lighting Co., Inc.....	New York.....	$8,000	June
Carmel Light & Power Co., Inc..	New York.....	$28,700	June
Haverhill Electric Co.:			
Newburyport Gas & Elec. Co...	Newburyport, Mass.	$1,849,855	*Sept.
Houston Lighting & Power Co.:			
La Porte Light & Ice Co.....	LaPorte, Tex., and vicinity.....	$27,000	*Oct.
Hughes Electric Co.:			
Mandan Electric Co.....	Mandan, N. D.....	$100,000	*Dec.
Hebron Elec. Light & Power Co.	Hebron, N. D.....	$10,000	*Dec.
Gerving Elec. Light & Power Co.	Glen Ullin, N. D....	.....	*Dec.
Halliday Elec. Light Plant.....	Halliday, N. D.....	.....	*Dec.
Illinois Power & Light Co.:			
Ashland Light, Mill & Pwr. Co....	Ashland, Neb.....	$65,000	Feb.
Spring Valley Utilities Co.....	Spring Valley, Ill., and vicinity.....	$1,000,000	*Mar.
Mackinaw Electric Light Co....	Mackinaw, Ill.....	$8,000	Nov.
Vandalia Municipal.....	Vandalia, Ill.....	$190,000	*Nov.
Illinois Public Service Co.:			
Mt. Pulaski Electric Light, Heat & Power Co.....	Mt. Pulaski, Ill., and vicinity.....	$8,000	*Aug.

*Date reported in ELECTRICAL WORLD. †Estimated.

Mergers of Central-Station Systems During 1925 (Continued)

Companies Involved	Territory Served	Capitalization	Date of Merger
Homer Elec. Light & Pwr. Co Bement Elec. Light & Pwr. Co. Lincoln Water, Lt. & Pwr. Co. Freeport Gas & Light Co. Mt. Pulaski Light & Gas Co. Bellflower Light & Power Co.	South Central Illinois	$5,000,000	*Aug.
Indiana and Michigan Electric Co.:			
Twin Branch Power Co.	Northern Indiana and Southwestern Michigan	.....	Feb.
Interstate Public Service Co.:			
Brownstown Water & Light Co.	Brownstown, Ind.	$162,234	*July
Jackson County Trans. Co.			*July
Indiana Power Co.	Vincennes, Ind., and vicinity	$10,476,366	*Oct.
Vernon Hydro Electric Co.	Vernon, Ind.	$6,500	April
Iowa Light, Heat & Power Co.:			
Holstein Service Co.	Holstein, Iowa, and vicinity	$25,000	*May
Iowa Power & Light Co.			
Adel Light & Power Co.	Adel, Iowa, and vicinity	$50,000	*July
Castana Municipal	Iowa	.....	*Aug.
Ricketts Municipal	Iowa	.....	*Aug.
Schleswig Municipal	Iowa	$45,000	*Aug.
Iowa Railway & Light Corp.:			
Madrid Elec. Lt. & Pwr. Co.	Madrid, Iowa	$45,500	*July
Tri-State Utilities Co.—(Iowa division)	Central City, Ia., and vicinity	.....	Dec.
Iowa Southern Utilities Corp.:			
Burlington Ry. and Light Co.	Burlington, Iowa, and vicinity	$4,411,000	*Jan.
Peoples Gas and Electric Co.	Mason City, Iowa	$636,000	*Jan.
Iowa Gas & Electric Co.	Washington, Iowa, and vicinity	$954,400	.....
Lamoni Electric Co.	Lamoni, Iowa, and vicinity	$60,000	*June
Jersey Central Power & Light Co.:			
Millburn Electric Co.	New Jersey	$21,907,882	July
Central Jersey Power & Lt. Co.			Feb.
Lakewood & Coast Elec. Co.			Feb.
Monmouth Lighting Co.			Feb.
Shore Lighting Co.			Feb.
Toms River Elec. Co.			Feb.
Tri County Elec. Co.			Feb.
Kentucky Power Company:			
Carrolton Municipal	Carrollton, Ky.	†$96,000	*June
Kentucky-Tennessee Light & Power Co.:			
Mayfield Municipal	Mayfield, Ky.	$270,000	June
Hardinsburg Municipal	Hardinsburg, Ky.	$10,000	June
Hawesville Municipal	Hawesville, Ky.	$15,000	June
Lewisport Municipal	Lewisport, Ky.	$4,000	June
Cloverport Municipal	Cloverport, Ky.	.....	June
Kentucky Utilities Co.:			
Paducah Electric Co.	Paducah, Ky.	$1,780,000	*Nov.
Cannelton Elec. Lt. & Pwr. Co.	Cannelton, Ind.	$19,000	*Dec.
Lake Erie Light & Power Co.:			
Bellevue Illuminating Co.	Huron County, Ohio	$161,000	*Aug.
Wm. Levering of Philadelphia:			
Mutual Light & Water Co.	Brunswick, Ga.	$796,701	*Sept.
Louisiana Public Utilities, Inc.:			
Morgan City Elec. Co., Ltd.	Morgan City, La.	$25,000	*Sept.
Lynchburg Traction & Light Co.:			
Amherst Light & Power Co.	Amherst, Va.	$20,000	*July
Memphis Light & Power Co.:			
South Memphis Lt. & Trac. Co.	Memphis, Tenn.	$145,000	June
Michigan Electric Power Co.:			
Great Lakes Power Co.	Sanilac, Huron, Tuscola, Lapeer and Genessee Counties, Mich.	$1,844,953	*Feb.
Lapeer Gas Electric Co.			*Feb.
Central Power Co.			*Feb.
Consumers Heating Co.			*Feb.
Caro Light & Power Co.			*Feb.
Middle West Utilities Co.:			
Chicago & Joliet Elec. Ry. Co.	Joliet, Quincy, Ill., and vicinity	$6,278,653	*Jan.
Midwest Utilities Co.:			
Baker Light & Power Co.	Baker, Mont.	†$64,000	*Dec.
Central Power & Light Co.	Texas, Oklahoma, Arkansas, Kansas, Mississippi and Mexico	$21,457,273	July
Central Maine Power Co.	Central Maine	$29,190,511	June
Southwestern Gas & Elec. Co.	Louisiana, Arkansas, Texas, Mississippi	$16,119,648	*Aug.
Central Wisconsin Power Co.	Wisconsin	$2,000,000	*Aug.
Maltoon Public Service Co.			*Aug.
Wittenberg Light & Power Co.			*Aug.
Leopolis Elec. Lt. & Pwr. Co.			*Aug.
Manchester Traction Light & Power Co.	Manchester, N. H., and vicinity	$13,186,686	July
Midland Utilities Co.:			
Indiana Service Corp.	Ft. Wayne, Ind., and vicinity	$19,758,726	Mar.
Mississippi Power & Light Co.:			
Raymond, Municipal	Raymond, Miss.	.....	*Aug.
Missouri Light Co.:			
La Belle Municipal	La Belle, Mo.	†$24,000	*Oct.
Missouri Power Co.:			
Mountain Grove Creamery Ice & Electric Co.	Mountain Grove, Mo.	$130,000	*Oct.
Clinton Municipal	Clinton, Mo.	†$64,000	*Oct.
Mohawk & Hudson Power Corp.:			
Cohoes Power & Light Corp.	Cohoes, N. Y., and vicinity	$8,204,190	July
Fulton County Gas & Elec. Co.	Gloversville, N. Y., and vicinity	$5,578,314	July
Utica Gas & Electric Co.	Utica, N. Y., and vicinity	$26,151,125	July
Adirondack Power & Lt. Corp.	Schenectady, N. Y., and vicinity	$54,166,447	July
Mohawk Valley Co.:			
Hilton Elec. Lt. & Power Co.	Hilton, N. Y.	.....	*April
Cooper Electric Co.	Parma, N. Y.	.....	*April.
Monongahela West Penn Public Service Co.:			
Brooke Electric Co.	Wellsburg, W. Va.	$63,000	*Feb.
West Virginia & Maryland Power Co.	West Virginia and Maryland	.....	*Feb.
Parsons Electric Co.	Parsons, W. Va.	$25,000	*Feb.
West Virginia Pub. Service Co.	West Virginia	.....	*Feb.
St. Marys Power & Light Co.	St. Marys, W. Va.	$50,000	*Feb.
West Maryland Power Co.	Oakland, Md.	.....	*Feb.
Mountain States Power Co.:			
Natrona Power Co.	Casper, Wyo.	$1,550,000	April
Coast Power Co.	Tillamook, Ore., and vicinity	$257,000	April
Narragansett Electric Lighting Co.:			
Westerly Light & Pwr. Co.	Rhode Island	$1,146,000	*May
Narragansett Pier Elec. Light & Power Co.		$130,000	*May
Wickford Light & Power Co.		$50,000	*May
National Electric Power Co.:			
Cumberland County Power & Light Co.	Portland, Me., and vicinity	$16,846,888	Mar.
Northwestern Pub. Ser. Co.	Nebraska and South Dakota	$7,507,415	Mar.
Kansas Electric Power Co.	Lawrence, Kan., and vicinity	$9,515,777	July
Eastern Kansas Power Co.	Eureka, Kan., and vicinity	$448,865	July
Ohio Electric Power Co.	Oberlin, Ohio	$1,131,850	July
Southwest Power Co.	Oklahoma and Arkansas	$6,195,733	July
Williamson Electric Co.	Williamson, W. Va., and vicinity	$459,574	July
National Power & Light Co.:			
United Investors' Securities Co.			*Dec.
Carolina Power & Light Co.	Raleigh, N. C., and vicinity	$36,605,509	*Nov.
National Public Service Corp.:			
Florida Power Co.	Ocala, Fla., and vicinity	$150,000	*Mar.
Electric Service Co. of Kansas.	Dodge City, Kan., and vicinity	$399,800	*April
Valdosta Lighting Co.	Valdosta, Ga.	$969,500	*Aug.
Municipal Service Co.	A holding company.	.....	June
Eastern Shore Gas & El.ctric Co.	Delaware and Maryland	$3,065,432	Sept.
Virginia Western Power Co.	Virginia and West Virginia	$8,078,971	*July
Virginia Northern Power Co.	Virginia	$571,035	*Nov.
Nebraska Gas & Elec. Co.:			
Humboldt, Nebr. plant	Humboldt, Neb.	$200,000	*May
New Jersey Power & Light Co.:			
Blair Electric Light Co.	New Jersey	.....	*July
Eastern Penna. Power Co.	Columbia, N. J., and vicinity	$2,000	*Dec.
New Mexico Utilities Co.:			
Clovis Municipal	Clovis, N. M.	†$315,000	*Oct.
New York Central Corp.:			
Empire Gas & Electric Co.	Central New York	$11,234,801	Jan.
Savona Municipal	Savona, New York	$20,000	Dec.
NewYork State Gas & Electric Corp.:			
Livingston Manor Electric Co.	Central New York	$43,500	June
Berholme Power Co., Inc.		.....	June
Roxbury Light & Power Co.		.....	June
Earlville Electric Light Co.		$23,000	June
Windham Valley Electric Co.		.....	June
Southern New York Pwr. Co.		$1,917,400	Dec.
Madison Power Co., Inc.		$173,700	Dec.
Sullivan Co. Light & Pwr. Co.		$429,000	Dec.
Waterville Gas & Electric Co.		$28,800	Dec.
Delaware County Electric Lt. & Power Co.		$6,500	Dec.
New Berlin Lt. & Power Co.		$12,200	Dec.
Fleischmanns Light, Heat & Power Co.		$6,400	Dec.
Moravia Elec. Lt. & Pwr Co.		$27,500	Dec.
West Branch Lt. & Pwr Co.		$85,000	Dec.
Steven O'Connor elec. plant		.....	Dec.
New York Vermont Interstate Power Co.:			
Halfmoon Light, Heat & Power Co.	Eastern New York	$273,500	June
Eastern New York Electric & Gas Co.		$760,232	June
Dwaas Electric Co.		$11,600	June
Salem Lt., Heat & Power Co.		$50,000	June
New England Public Service Co.:			
Central Maine Power Co.	Maine	$10,552,700	*Oct.
Manchester Traction Light & Power Co.	New Hampshire	$9,898,300	*Oct.
National Lt., Heat & Pwr. Co.	New England States	$5,548,079	*Oct.
New Orleans Public Service, Inc.:			
Consumers Electric Light & Power Co.	New Orleans	$3,385,000	
Citizens Light & Power Co.		$706,300	*Dec.
Niagara, Lockport & Ontario Power Co.:			
Camden Municipal	Camden, N. Y.	$30,560	*Jan.
Olean Elec. Lt. & Power Co.	Olean, N. Y., and vicinity	$1,837,000	*April
North American Co.:			
Western Power Corp.	California	$96,402,196	*Sept.
Mississippi River Power Co.	Iowa, Illinois, Missouri	$32,664,400	*Oct.
Livingston-Niagara Power Co.	Avon, N. Y., and vicinity	$396,000	*April
Western New York Elec. Co.	Jamestown, N. Y., and vicinity	.....	*April
Bryant Power Co.	Wilson, N. Y.	.....	*April

*Date reported in ELECTRICAL WORLD. †Estimated.

Mergers of Central-Station Systems During 1925 (Continued)

Companies Involved	Territory Served	Capitalization	Date of Merger
Northeastern Iowa Power Co.:			
Colwell Municipal	Colwell, Iowa	.....	*June
Northern Maryland Power Co.:			
Elkton Electric Co.	Elkton, Md.	†$64,000	*May
Havre de Grace Electric Co.	Havre de Grace, Md.	†$172,000	*May
Northern Power & Light Co.:			
Mobridge Elec. Co.	Mobridge, S. D., and vicinity	$186,500	*July
Boyle Electric Co.	Gettysburg, S. D.	.....	*July
Dakota Utilities Co.	Eureka, S. D.	$93,000	*July
New Era Power Co.		.....	*July
Sheets Electric Co.	Lemmon, S. D.	†$25,600	*July
Northwest Utilities Co.:			
Beloit Water, Gas & Elec. Co.	Beloit, Wis., and vicinity	$4,237,814	*July
Northwestern Light and Power Co.:			
Pierson Municipal	Pierson, Iowa	$1,500	*Oct.
Ohio Electric Power Co.:			
Electric Lt. & Power business of Cleveland, Southwestern Ry. & Light Co.	Vicinity of Norwalk and Elyria, Ohio.	Price=$161,000	*Feb.
Oklahoma Gas & Electric Co.:			
Consumers Light & Power Co.	Ardmore and Durant, Okla.	†$1,110,000	*Aug.
Tishomingo, Okla. Municipal	Tishomingo, Okla.	$50,000	*Oct.
Oklahoma Power Co.:			
Okemah Municipal	Okemah, Okla.	$98,000	*April
Olean Electric Light & Power Co.:			
Cuba Electric Co.	Cuba, N. Y.	$83,300	*April
Otter Tail Power Co.:			
Sheyenne Valley Lt. & Pwr. Co.	Valley City, N. D., and vicinity	$96,000	*April
Ozark Utilities Co.:			
South Missouri Power Co.	Greenfield, Mo., and vicinity	$250,000	*Nov.
Southwest Elec. Lt. & Mill Co.	Sarcoxie, Mo., and vicinity	$40,000	*Nov.
Jasper Electric Co.	Jasper, Mo.	.....	*Nov.
Pacific Power & Light Co.:			
Washington-Idaho Water, Light & Power Co.	Washington and Idaho	$1,125,000	*Jan.
Penn Central Light & Power Co.:			
United Lighting Co.	Albion and Conneautville, Pa.	$237,272	*Nov.
Penna Power & Light Co.:			
East Penn Electric Co.	Eastern Pennsylvania	$17,121,699	Jan.
Power & Electric Securities Corp.:			
Malone Light & Power Co.	Northern New York	$1,591,483	*Nov.
Fort Covington Light, Heat & Power Co.	Northern New York	$21,500	*Nov.
Milling & Lighting Company of Brasher Falls	Northern New York	$6,000	*Nov.
Portland, Electric Power Co.:			
St. Helen's Light & Pwr. Co.	St. Helen's, Ore.	†$64,000	*Oct.
Public Service Co. of Colo.:			
Tonopah Placers Co.	Breckenridge, Col., and vicinity	†$80,000	*Nov.
Public Service Co. of Mo.:			
Property of Missouri Public Utilities Co. in 18 communities	Missouri	Price=$2,750,000	*Feb.
Public Service Co. of Okla.:			
Afton Municipal	Afton, Okla.	$54,000	*Oct.
Puget Sound Power & Light Co.:			
Property of Northwestern Power & Mfg. Co. in Port Angeles, Sequin, Silverdale, and Poulsbo	In Olympic Peninsula, Wash.	.....	*Nov.
North Pacific Pub. Service Co.	Bremerton, Wash.	$681,000	*Nov.
Sequim Light & Power Co.	Sequim, Wash.	$80,000	*Dec.
Republic Railway & Light Co.:			
Northeastern Ohio Power & Light Co.	Shore of Lake Erie east and west from Astabula, Ohio	.....	*Dec.
Grand River Electric Light & Power Co.	Shore of Lake Erie east and west from Astabula, Ohio	$63,300	*Dec.
Surburban Utilities Co.	Shore of Lake Erie east and west from Astabula, Ohio	.....	*Dec.
Southeastern Power & Light Co.:			
Meridian Light & Ry. Co.	Meridian, Miss.	$3,723,500	*April
Hattiesburg, Traction Co.	Hattiesburg, Miss.	$1,054,000	*April
Mobile Electric Co.	Mobile, Ala.	$5,225,280	*Jan.
Pensacola Electric Co.	Gulf Coast of Florida	$3,291,358	*Feb.
Southern Cities Power Co.:			
Fayetteville Electric Light & Power Co.	Fayetteville, Tenn.	$435,000	*Aug.
Southern Cities Utilities Co.:			
Sequatchie Light & Power Co.	Hohenwald and Petersburg, Tenn.	.....	*Oct.
Southern Penna. Power Co.:			
Northern Maryland Power Co.	Northern Maryland.	.....	*June
Southside Virginia Power Co.:			
Halifax Power Co.	Virginia	$3,812,953	*Oct.
Piedmont Power Co.	Virginia	.....	*Nov.
Southwestern Light & Power Co.:			
Consumers Light & Power Co. of Okla.	Waurika, Okla.	†$128,000	*July
Hollis Light & Ice Co.	Hollis, Okla.	†$97,000	*Aug.
Southwestern Public Service Co.:			
City Lt. & Water Co.	Amarillo, Tex.	$2,784,946	July
Standard Power & Light Corp.:			
Pittsburgh Utilities Co.	Pennsylvania	$26,617,901	July
United Rys. Investment Co.	Pennsylvania	$255,685,956	July
Philadelphia Co.	Pennsylvania		
Surburban Power Co.:			
Properties of Gen'l Light & Power Co. in Bristolville, North Bristol, Bloomfield, Louisville, Harrisburg and Middle Branch	Ohio	$136,000	*Oct.
Southern Power Co.:			
Southern Public Utilities Co.	North and South Carolina	$25,424,449	*Dec.
Southern Ohio Electric Co.:			
Hocking Power Co.	Nelsonville, Ohio	$394,176	*Dec.
Mutual Electric Co.	Middleport, Ohio	$95,700	*Dec.
Southern Ohio Power Co.	Floodwood, Ohio	$3,915,239	*Dec.
Chas. H. Tenney & Co.:			
Newburyport Gas & Electric Co.	Newburyport, Mass., and vicinity	$1,849,855	*April
Tennessee Electric Power Co.:			
Smith County Electric Co.	Carthage, Tenn., and vicinity	$62,500	*May
Murfreesboro Light & Pwr. Co.	Murfreesboro, Tenn.	$700,000	*Dec.
Texas Central Power Co.:			
Luling Electric Lt. & Power Co.	Luling, Tex.	$200,000	*Sept.
Texas Power & Light Co.:			
Citizens Water & Light Co.	Lockport, Tex., and vicinity	$15,000	*April
Twin State Gas & Electric Co.:			
Jones & Linscott Elec. Co.	Lancaster, N. H.	$60,000	*Aug.
Union Electric Light & Power Co.			
Mississippi River Power Co.	Missouri, Iowa, Illinois	$49,695,460	*Oct.
Union Gas & Electric Co.:			
Oxford Municipal	Oxford, Ohio	$45,000	*Aug.
United Gas Improvement Co.:			
Iowa Light, Heat & Power Co.	Northwest Iowa	$4,623,101	*June
United Light & Power Co.:			
Plants of Ohio Utilities Co. at Circleville, Delaware, Hicksboro and Gallipolis	Ohio	.....	*Aug.
Chillicothe Elec. R.R. Light & Power Co.	Ohio	$175,000	*Aug.
Columbus Ry. Power & Light Co.	Ohio	$41,735,416	*Aug.
Blue River Power Co.	Nebraska	$1,000,000	*Oct.
Continental Gas & Electric Corp.	Missouri, Iowa, Nebraska, Ohio and Manitoba	$133,610,294	*Jan.
Utah Power & Light Co.:			
Clark Electric Power Co.	Tooele, Utah and vicinity	$100,000	*Feb.
Vernal Light Co.	Vernal, Utah	$125,000	*Nov.
Green River Elec. Lt. & Pwr. Co.	Green River, Wyo.	$30,000	*Dec.
Utilities Power & Light Corp.:			
Colonial Gas & Electric Co.	Newport, R. I., and vicinity	$2,969,741	*April
Clinton Gas & Electric Co.	Clinton, Iowa, and vicinity	$1,540,000	*May
Ocean Grove Camp Meeting Assoc.	Ocean Grove, N. J.	†$239,000	*Oct.
Valdosta Lighting Co.:			
Madison Municipal	Madison, Fla.	$30,000	*Aug.
Virginia Ry. & Power Co.:			
Williamsburg Power Co.	Williamsburg, Va.	$150,000	*Oct.
Ware County Light & Power Co.:			
Blackshear Municipal	Blackshear, Ga.	†$64,000	*Aug.
Western Power Corp.:			
San Joaquin Light & Pwr. Corp.	Fresno, Cal., and vicinity	$57,042,700	Feb.
Western Reserve Power Co.:			
Properties of Cleveland & S. W. Ry. & Light Co. in Nova, West Salem, Sullivan & Spencer, O.	Ohio	Price $45,000	*Oct.
East Ohio Power & Light Co.	Medina, Ohio	$200,000	*Oct.
Western United Corp.:			
Western United Gas & Elec. Co.	Illinois	$18,661,611	*Jan.
Southern Illinois Gas Co.	Illinois	$3,065,098	*Jan.
West Texas Utilities Co.:			
Ballinger Municipal	Ballinger, Tex.	$85,000	*May
Western United Gas & Elec. Co.:			
Fox River Elec. Co.	Southern Illinois.	.....	*Nov
Aurora, Elgin & Fox River Elec. Co.	Southern Illinois.	.....	*Nov.
Western Utilities Co.:			
Evans Light Co.	Malad, Idaho	†$143,000	*Oct.
Wisconsin Power and Light Company:			
Marquette Electric Company		30,000.00	
Village of Dane		6,000.00	
Interurban Electric Company		14,500.00	
Princeton Power and Light Company		48,470.60	
Mauston Electric Service Company		179,398.12	
Montello-Harrisville Electric Light & Power Co.		44,635.50	
Fall River Electric Company		29,000.00	
Orange Light and Power Company		31,500.00	
Rose Milling Company of Wild Rose		24,000.00	
Portage American Gas Company		138,659.06	
Westford Light, Heat & Power Company		15,982.31	
Cagenovia Village		8,000.00	
Orfordville Light and Power Company		22,000.00	
Lime Ridge Village		4,104.38	
Rio Electric Company		28,000.00	
Pine River Village		16,000.00	
Poy Sippi Village		24,000.00	
Coloma Village		200.00	
Twin Bluffs Electric Company		35,000.00	
Fairwater Electric Company		42,000.00	
Electric Power Plant of Sardeson Brothers at Blanchardville		20,000.00	
Ironton Village		1,200.00	
Brooklyn Electric Company		10,000.00	
Aurorahville Village		10,000.00	
Merrimac Electric Company		7,850.00	
Verona Village		40,000.00	
Wisconsin Public Service Corp.:			
Peshtigo Pulp & Paper Co.	Potersfield Dam, Wis.	$334,000	*July
Wisconsin Valley Electric Co.:			
Waupaca Elec. Ser. & Ry. Co.	Waupaca, Wis.	$238,060	*Sept.

*Date reported in ELECTRICAL WORLD. †Estimated.

Central-Station Lighting and Power Customers, Showing Growth During 1923, 1924 and 1925

State	Total Domestic Lighting Customers				Total Commercial Lighting Customers				Total Industrial Power Customers				Total Central-Station Customers of All Kinds				Percentage Increase in Domestic Lighting Customers—Jan. 1, 1925, to Jan. 1, 1926	
	Jan. 1, 1924	Jan. 1, 1925	Jan. 1, 1926	New Customers Added During 1925	Jan. 1, 1924	Jan. 1, 1925	Jan. 1, 1926	New Customers Added During 1925	Jan. 1, 1924	Jan. 1, 1925	Jan. 1, 1926	New Customers Added During 1925	Jan. 1, 1924	Jan. 1, 1925	Jan. 1, 1926	New Customers Added During 1925	In Cities of 25,000 Population and Over	In Cities Under 25,000 Population
United States	11,623,644	13,406,777	14,532,930	1,126,153	2,258,347	2,588,983	2,781,280	192,297	502,736	570,844	622,950	52,106	14,384,727	16,566,604	17,937,160	1,370,556	9.4	7.0
New England	1,055,520	1,207,530	1,318,700	111,170	222,890	244,320	264,330	20,010	45,307	49,282	53,100	3,818	1,323,717	1,501,132	1,636,130	134,998	10.1	8.1
Middle Atlantic	2,571,530	3,096,802	3,461,300	364,498	544,039	669,168	728,900	59,732	93,608	106,902	116,180	9,278	3,209,177	3,872,872	4,306,380	433,508	11.6	12.0
South Atlantic	748,450	894,902	966,700	71,798	164,735	190,368	203,440	13,072	33,770	39,575	43,370	3,795	946,955	1,124,845	1,213,510	88,665	9.6	6.1
East North Central	3,183,140	3,535,823	3,829,600	293,777	556,424	612,063	656,300	44,237	114,319	123,872	133,550	9,678	3,853,883	4,271,758	4,619,450	347,692	9.6	5.9
West North Central	1,290,837	1,475,953	1,565,850	89,897	253,746	279,438	291,750	12,312	53,668	63,250	67,650	4,400	1,598,251	1,818,641	1,925,250	106,609	6.2	6.0
East South Central	378,137	453,782	498,500	44,718	76,259	89,657	96,670	7,013	20,121	22,917	24,700	1,783	474,517	566,356	619,870	53,514	14.5	5.8
West South Central	722,520	814,118	861,650	47,532	126,135	142,863	150,610	7,747	29,037	34,362	38,360	3,998	877,692	991,343	1,050,620	59,277	4.7	6.7
Mountain	411,250	449,872	464,330	14,458	60,645	69,422	73,250	3,828	17,428	20,784	22,420	1,636	489,323	540,078	560,000	19,922	2.3	3.7
Pacific	1,262,260	1,477,995	1,566,300	88,305	253,474	291,684	316,030	24,346	95,478	109,900	123,620	13,720	1,611,212	1,879,579	2,005,950	126,371	6.8	4.5
New England																		
Maine	115,710	140,480	152,000	11,520	30,940	33,280	36,400	3,120	5,508	6,726	7,340	614	152,158	180,486	195,740	15,254	9.7	7.8
New Hampshire	46,190	57,420	63,200	5,780	10,410	12,930	13,830	900	2,860	3,159	3,350	191	59,460	73,509	80,380	6,871	10.0	10.1
Vermont	50,870	55,310	59,600	4,290	11,210	12,260	13,100	840	2,418	2,767	2,930	163	64,498	70,337	75,630	5,293	....	7.8
Massachusetts	550,490	628,030	686,000	57,970	113,540	125,060	137,700	12,640	21,583	23,234	25,450	2,216	685,613	776,324	849,150	72,826	9.7	8.2
Rhode Island	72,290	86,030	95,500	9,470	16,860	18,090	18,350	260	3,335	3,482	3,660	178	92,485	107,602	117,510	9,908	12.5	8.2
Connecticut	219,970	240,260	262,400	22,140	39,930	42,700	44,950	2,250	9,603	9,914	10,370	456	269,503	292,874	317,720	24,846	10.3	8.0
Middle Atlantic																		
New York	1,183,130	1,411,760	1,554,800	143,040	289,870	373,603	405,000	31,397	43,461	51,865	55,800	3,935	1,516,461	1,837,228	2,015,600	178,372	9.7	12.1
New Jersey	446,390	563,160	659,000	95,840	84,530	107,180	126,000	18,820	16,419	19,914	22,380	2,466	547,339	690,254	807,380	117,126	17.0	17.3
Pennsylvania	942,010	1,121,882	1,247,500	125,618	169,639	188,385	197,900	9,515	33,728	35,123	38,000	2,877	1,145,377	1,345,390	1,483,400	138,010	12.0	10.1
South Atlantic																		
Delaware	19,624	21,112	23,300	2,188	5,551	5,602	5,800	198	713	776	845	69	25,888	27,490	29,945	2,455	10.3	11.0
Maryland	123,900	163,060	180,700	17,640	23,129	27,270	28,650	1,380	3,823	4,205	4,635	430	150,852	194,535	213,985	19,450	10.8	11.0
District of Columbia	42,920	59,000	65,000	6,000	16,410	19,400	20,450	1,050	2,500	2,665	2,900	235	61,830	81,065	88,350	7,285	10.2	....
Virginia	105,210	118,050	127,200	9,150	12,050	15,474	16,380	906	7,071	7,910	8,520	610	124,331	141,434	152,100	10,666	7.2	8.6
West Virginia	71,430	88,530	95,300	6,770	16,850	20,126	22,400	2,274	2,998	4,058	4,390	332	91,278	112,714	122,090	9,376	7.2	7.9
North Carolina	99,306	127,170	137,700	10,530	27,620	31,364	35,000	3,636	5,098	6,793	7,760	967	132,024	165,327	180,460	15,133	15.0	5.7
South Carolina	59,690	68,660	71,600	2,940	15,070	16,316	16,630	314	2,455	2,804	2,950	146	77,215	87,780	91,180	3,400	5.8	3.7
Georgia	117,570	127,234	133,700	6,466	25,675	27,150	27,550	400	5,842	6,319	6,770	451	149,087	160,703	168,020	7,317	5.8	4.5
Florida	108,800	122,086	132,200	10,114	22,380	27,666	30,580	2,914	3,270	4,045	4,600	555	134,450	153,797	167,380*	13,583*	9.6	4.5
East North Central																		
Ohio	825,288	910,423	1,012,000	101,577	124,948	141,220	156,000	14,780	22,667	23,265	25,530	2,265	972,903	1,074,908	1,193,530	118,622	13.6	5.8
Indiana	367,260	405,785	435,000	29,215	60,060	62,085	67,000	4,915	16,233	17,958	19,570	1,612	443,553	485,828	521,570	35,742	7.7	6.9
Illinois	1,112,250	1,220,390	1,300,000	79,610	211,550	231,314	240,400	9,086	36,110	39,773	42,150	2,377	1,359,910	1,491,477	1,582,550	91,073	6.6	6.3
Michigan	596,362	663,121	723,000	59,879	99,816	108,514	118,500	9,986	21,696	23,396	24,850	1,454	717,874	795,031	866,350	71,319	11.2	4.7
Wisconsin	281,980	336,104	359,600	23,496	60,050	68,930	74,400	5,470	17,613	19,480	21,450	1,970	359,643	424,514	455,450	30,936	8.4	5.4
West North Central																		
Minnesota	319,840	370,838	395,000	24,162	59,070	63,099	65,600	2,501	13,989	16,613	17,940	1,327	392,899	450,550	478,540	27,990	4.8	8.2
Iowa	231,550	264,564	278,250	13,686	48,270	54,371	56,750	2,379	11,263	13,732	14,500	768	291,083	332,667	349,500	16,833	5.9	3.0
Missouri	354,660	397,410	427,900	30,490	77,060	83,113	87,000	3,887	11,787	13,116	14,220	1,104	443,507	493,639	529,120	35,481	7.8	7.2
North Dakota	26,385	32,210	33,200	990	5,826	7,373	7,650	277	1,239	1,578	1,700	122	33,450	41,161	42,550	1,389	....	3.0
South Dakota	41,080	47,194	48,600	1,406	8,260	10,202	10,600	398	2,753	3,624	3,840	216	52,093	61,020	63,040	2,020	....	3.0
Nebraska	118,417	130,650	136,300	5,650	21,340	22,635	23,550	915	5,519	6,455	6,810	355	145,276	159,740	166,660	6,920	4.7	4.0
Kansas	198,905	233,087	246,600	13,513	33,920	38,645	40,600	1,955	7,118	8,132	8,640	508	239,943	279,864	295,840	15,976	5.0	6.3
East South Central																		
Kentucky	122,137	150,702	163,600	12,898	28,408	32,086	34,400	2,314	7,057	7,969	8,600	631	157,602	190,757	206,600	15,843	12.1	5.2
Tennessee	125,390	160,030	179,000	18,970	23,910	28,803	30,700	1,897	6,917	8,293	8,700	407	156,217	197,126	218,400	21,274	14.7	7.6
Alabama	91,620	99,930	111,400	11,470	15,391	19,390	21,600	2,210	4,103	4,436	5,040	604	111,114	123,756	138,040	14,284	17.8	6.1
Mississippi	38,990	43,120	44,500	1,380	8,550	9,378	9,970	592	2,044	2,219	2,360	141	49,584	54,717	56,830	2,113	....	3.2
West South Central																		
Arkansas	82,500	88,790	92,300	3,510	15,220	16,270	17,250	980	2,534	3,121	3,340	219	100,254	108,181	112,890	4,709	4.0	3.8
Louisiana	84,510	94,860	98,050	3,190	21,045	22,598	23,960	1,362	4,320	4,865	5,200	335	109,875	122,323	127,210	4,887	3.4	3.4
Oklahoma	144,690	172,158	180,800	8,642	25,280	28,122	29,600	1,478	7,891	9,387	11,400	2,013	177,861	209,667	221,800	12,133	5.0	5.2
Texas	410,820	458,310	490,500	32,190	64,590	75,873	79,800	3,927	14,292	16,989	18,420	1,431	489,702	551,172	588,720	37,548	5.0	8.7
Mountain																		
Montana	54,820	60,731	62,950	2,219	10,865	11,976	12,770	794	2,805	3,297	3,510	213	68,490	76,004	79,230	3,226	2.2	3.9
Idaho	45,040	48,321	50,800	2,479	10,300	11,203	11,830	627	1,788	1,887	2,000	113	57,128	61,411	64,630	3,219	....	5.1
Wyoming	26,010	27,290	27,400	110	3,080	3,331	3,360	29	1,047	1,265	1,280	15	30,137	31,886	32,040	154	....	0.4
Colorado	133,190	146,670	150,800	4,130	19,820	21,900	23,000	1,100	6,779	8,140	8,910	770	159,789	176,710	182,710	6,000	2.2	3.6
New Mexico	18,100	19,550	20,400	850	3,110	3,334	3,550	216	817•	942	1,000	58	22,027	23,826	24,950	1,124	....	4.4
Arizona	25,670	29,090	30,550	1,460	1,460	4,775	5,190	415	1,455	1,776	1,930	154	31,585	35,641	37,670	2,029	2.7	5.3
Utah	96,240	104,630	107,800	3,170	10,160	10,774	11,310	536	2,252	2,936	3,210	274	108,652	118,339	122,320	3,980	2.2	3.8
Nevada	12,180	13,590	13,630	40	1,850	2,129	2,240	111	485	542	580	38	14,515	16,261	16,450	189	....	0.3
Pacific																		
Washington	233,530	248,160	266,500	18,340	36,164	41,981	45,500	3,519	11,886	13,954	19,370	3,416	281,580	304,095	329,370	25,275	8.6	5.3
Oregon	126,050	137,943	145,300	7,357	20,250	22,063	23,530	1,467	6,906	7,739	8,400	661	153,206	167,745	177,230	9,485	6.1	4.5
California	902,680	1,091,892	1,154,500	62,608	197,060	227,640	247,000	19,360	76,686	88,207	97,850	9,643	1,176,426	1,407,739	1,499,350	91,611	6.6	4.3

New Customers in 1925 Number 1,370,556

Large Decrease in Annual Number of Consumers Added—63,100,000 Persons in United States Now Live in Electrically Lighted Abodes—53 per Cent of Lighting Customers Use 110 Volts Alternating Current

BASED upon reports received from central-station companies representing 70 per cent of the generator rating of the country and covering all sizes of companies from the smallest to the largest, it is estimated that on January 1, 1926, there were a total of 17,937,160 central-station customers of all kinds in the country. This is an increase of 1,370,556 customers during 1925, against 2,181,877 reported in 1924 and 2,050,007 in 1923. It was hardly to be expected that the taking on of more than two million customers in one year, as in 1923 and 1924, could last indefinitely. There is an economic limit to any type of growth, and this limit seems to have been reached in the number of central-station customers possible of addition each year.

The reduction in number of customers added during the twelve-month period was common to all three types of customers—domestic lighting, commercial lighting and industrial power. Among the many basic factors underlying the marvelous progress of the electric light and power industry, especially since the war, building construction has played a very prominent part. Domestic and commercial building was materially below the estimated normal from 1917 through 1921. This subnormal construction activity resulted in a serious shortage of both domestic and commercial structures. The tide turned during the summer of 1921, since which time building construction has been far above the estimated normal. Many students of the building industry feel that the domestic and commercial housing shortage has now been wiped out and that the country will soon go back to the normal trend of construction. That this trend has already set in is clearly indicated in the decrease of almost 800,000 new customers added in 1925 as compared with 1924.

It is probable that 1926 and subsequent years will show still further material decreases in number of new customers added to the lines. The normal housing construction of the nation to take care of the increasing population is about 200,000 houses per annum, and a considerable proportion of these dwellings are in rural districts. It is estimated that today approximately 63,100,000 persons, or 54.4 per cent of the population of the country, are living in electrically lighted abodes. The total number of people living in urban communities, including villages of more than fifty population, is only approximately 74,000,000, or about 64 per cent of the total population of the country. There are, therefore, only about 11,000,000 people, or 2,600,000 families, in urban districts today not now living in electrically lighted abodes, and a large portion of these are living in tenement districts and cannot be considered as potential central-station customers for many years to come. The number of old houses possible of being wired at the present time for electric service is probably not in excess of 2,000,000.

The construction of office buildings and stores since 1921 has also wiped out the accumulated shortage existent at that time, and this type of construction should also witness a drop very soon. It is estimated that at the present time industry is 65 per cent electrified, and that there are at present 622,950 industrial power customers. The potential number of power customers is very difficult to estimate, especially the small power users, but it is doubtful whether there are more than 800,000 potential power users in the country at the present time.

All these factors point unmistakably to a material decrease in the number of central-station customers which will be added to the service lines in the years to come. The normal annual increase in number of customers of all kinds is probably around 200,000 per annum, but it will probably be several years before the number of customers added to the lines each year falls to this normal figure.

A study of the individual reports submitted by the central-station companies indicates that in most sections of the country the larger cities and towns are showing a higher rate of annual increase. In the Mountain States, however, the towns under 25,000 population reported a higher percentage of increase on the average than the towns over that population. In New York State and in New Jersey and some sections of the South Atlantic States the small towns on the average also reported the most rapid rate of growth.

New domestic lighting customers to the total of 1,126,153 were added to the central-station lines of the country during 1925, making 14,532,930 customers of this class on January 1, 1926. The greatest actual growth was reported by the Middle Atlantic States with 364,498 new customers, a drop of 160,774 under the increase reported in 1924. The East North Central States reported 293,777 new domestic customers, a drop of 58,906 under the new customers added in 1924. In fact, every section of the country reported a decrease in number of new customers added during the year.

The lowest rate of growth in customers was reported by the West North Central States, with a 6.0 per cent growth; the West South Central States, with a growth of 6.0 per cent, and the Mountain States, reporting a growth under 4 per cent. These are sections where few large cities are to be found, and the low increase reported by them was to be expected.

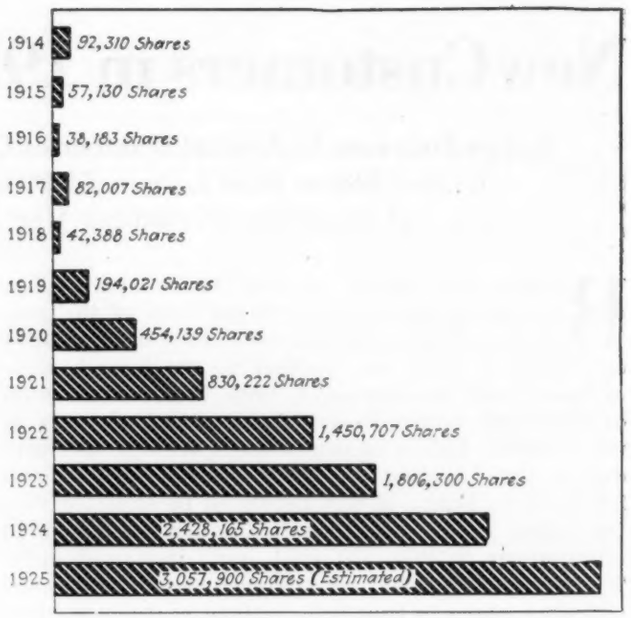
For the first time a study has been made of the number of domestic customers in accordance with the voltage used on the lighting circuits. This classification of the central-station customers should prove of large value in the manufacture and proper distribution of electrical appliances. It was found that there were fifteen voltages in use on the lighting circuits in the country using alternating current and six voltages on lighting circuits using direct current. As was to be expected, the standard 110-volt alternating-current circuits reported the greatest number of customers served, with 7,624,660, or 52.5 per cent of the total. Circuits of 115-volt alternating current reported 3,723,470 customers served, or 25.6 per cent of the total.

Customer-Ownership Sales $296,000,000

Record for 1925 Indicates a Material Increase Over That for the Preceding Year—Figures Represent a Total of 490,170 Transactions—New Stockholders About 360,000

THAT sales of securities by central-station companies direct to their customers were materially increased during 1925 is indicated from returns received by the ELECTRICAL WORLD during the past year. Based upon reports received from the companies for the first ten months of the year, it is estimated that the sales of securities direct to customers during the year totaled $296,000,000, an increase of $42,000,000, or 16.4 per cent above the 1924 sales as reported by the customer-ownership committee of the National Electric Light Association for that year. As indicated in the financial and corporate articles in this issue, this sale of securities direct to customers was approximately 23.3 per cent of the total new financing of the central-station industry during 1925. In 1924 the customer sales were 20.6 per cent of the total central-station financing done during the year.

A total of 3,057,900 shares of stock were sold to customers during 1925 as against 2,478,165 during 1924. A total of 490,170 transactions were recorded in the sale of this stock. Data have not been collected on the number of new stockholders obtained during the year, but, basing the figure upon past activities, it is estimated that the total was 360,000, bringing the aggregate number of stockholders obtained through customer-ownership sales to 1,307,000.



AN AVERAGE OF 265,000 SHARES OF STOCK WAS SOLD EACH MONTH DURING 1925

Security Sales 1920-1925, Inclusive

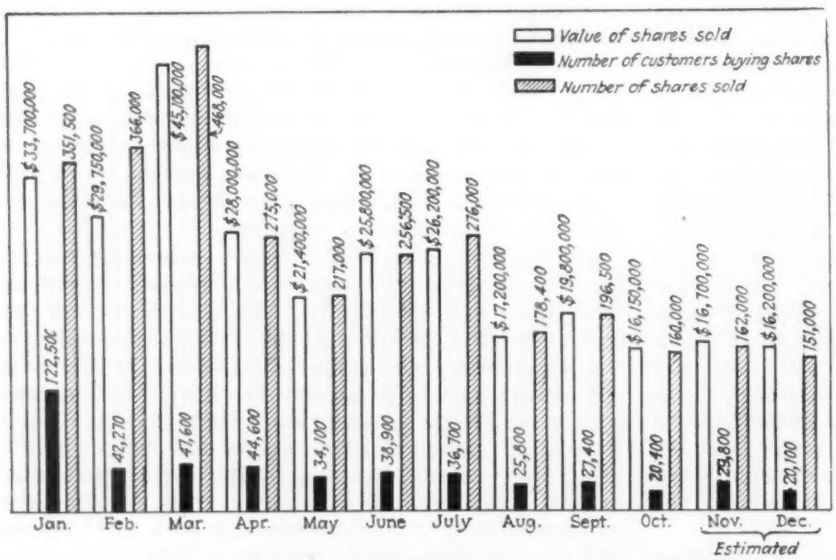
	Sales by Investment Houses	Sales Direct to Customers	Per Cent Direct to Customers
1920	$326,374,000	$43,000,000	11.7
1921	458,917,000	80,000,000	14.8
1922	589,961,000	130,000,000	18.1
1923	747,722,000	175,000,000	19.0
1924	982,421,000	254,000,000	20.6
1925	975,000,000†	296,000,000*	23.3
Total 1920–1925	$4,080,395,000	$978,000,000	19.4

*November and December estimated. †Last week of December estimated.

The returns received for the various months of 1925 establish a very interesting trend in this type of central-station financing. The year opened with a very high record of security sales, totaling $108,550,000 during the first three months, or over one-third the total sales for the year. Following March the general tendency was toward decreased sales, which tendency continued throughout the remainder of the year. It was but following the normal seasonal trend for the sales to drop during the summer months, but when they failed to pick up in the fall, as in 1924, a new trend was clearly indicated. Had the sales during the latter part of the year followed those reported for those months of 1924, the sales for the year would have been some $40,000,000 over the estimated total of $296,000,000.

This trend seems to bear out the statements made by students on the subject, that the industry is not giving this type of financing the attention which its potentialities warrant. A very large number of companies which sold securities under the customer-ownership plan during 1924 made no sales during 1925. If some of the other companies had not materially increased their sales over 1924 the total sales of the industry for the year would have been under those of the year previous.

The various operating companies report their monthly sales to the ELECTRICAL WORLD under a seal of confidence so that it is impossible to give figures on the sales by the various companies. But a study of the returns indicates that companies in the West taken as a whole increased their sales, while the average sales of the companies operating in the central western and eastern sections were below those reported in 1924.



A MATERIAL DROP IN CUSTOMER-OWNERSHIP SALES WAS RECORDED DURING THE LAST HALF OF THE YEAR

High-Voltage Insulation

Co-operative Research Brings New Facts to Light—Now Considering 132-Kv. Cables as Practicable—Survey of Experimental Work and Status of Insulation Breakdown Theory

By J. B. WHITEHEAD
Professor of Electrical Engineering Johns Hopkins University

THE facts that the insulation is usually the weakest and most uncertain link of high-voltage equipment and that it is least susceptible to exact engineering design mean that experimental development in this field is always active and productive of progress. Therefore, although the year just ended has not shown any noteworthy new departures in the insulation of high-voltage machinery and of high-voltage power lines, any seeming inactivity in these fields has been more than compensated by the attacks on the problem of the insulation of high-voltage cables. The insulation of cables is one of the most difficult of all, owing to their necessarily limited diameter and the difficulties in dissipating their losses. These difficulties have long been appreciated, but the increasing demand for higher voltages has in recent years resulted in an exceptional concentration of a number of powerful agencies on the problem.

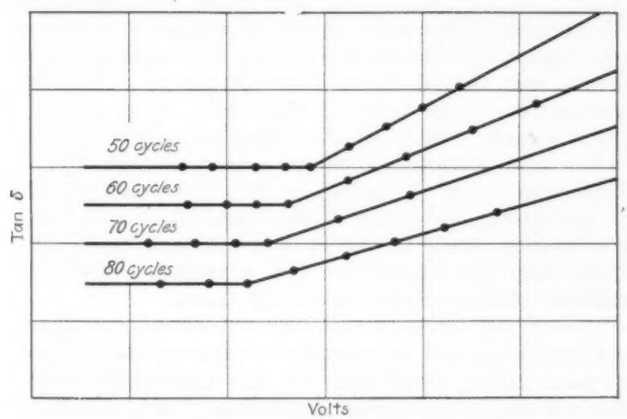


FIG. 1—IMPREGNATED PAPER INSULATION
Typical phase-difference (δ) vs. voltage curves, showing critical or ionization voltage.

First among these agencies must always be mentioned the manufacturers themselves, for it is they who must continue to experiment and develop new methods and devise the delicate operations for applying recognized improvements, through the limitations of manufacture in quantity of a finished, reliable product. Recently the manufacturers have not had an easy time. Some of their supposed improvements have been found to introduce unexpected difficulties in other features. Criticism has been leveled at them in the comparison, on the basis of both performance and life, of American cables with those of European manufacture. This criticism has already been found to have a healthy effect in stimulating a closer study by the manufacturers of the constituent parts and the methods of assembly, with resulting improvement in product. An especially promising enterprise of the manufacturers is the recent formation of the Power Cable Engineers Association, which should stimulate engineering co-operation among the several companies, expedite improvements, and work toward standardization.

Much of the recent activity of the manufacturers has been due to constant prodding and criticism by the central-station companies and other organizations. The Association of Edison Illuminating Companies, through its committee on high-tension cables; the National Electric Light Association, through its research and underground systems committees, and the American Institute of Electrical Engineers, through co-operation with each, not only have kept check on the performance, tests, and guarantees of cables, but they have properly considered it their function to stimulate and support research of a deeper character than is usually possible in a manufacturer's laboratory, and in quarters best qualified for the conduct of such research. Thus the impregnated paper insulation cable research committee, a joint committee of the A.E.I.C., the A.I.E.E. and the N.E.L.A., is supporting fundamental research on cable problems in the following institutions: Massachusetts Institute of Technology, on the life of impregnated paper insulation as affected by temperature; Johns Hopkins University, on ionization in impregnated paper insulation and its effect on life; Harvard University, on the study of the laws governing ionization in laminated ionization; University of Wisconsin, on the thermal conductivity of impregnated paper insulation. In addition to these, the same committee is directly supervising a number of important investigations made by Electrical Testing Laboratories, among them being the development of a standardized accelerated life test—that is, a test that can be made in a reasonably short time, and that can give reliable indication of the probable ultimate performance of the cable; also tests of the stability of impregnating compounds, and the development of standard "loads" that may be used as bases of comparisons of dielectric loss and power factor.

In addition to these regularly organized researches a number of field tests have also been conducted or are under way. Conspicuous among the latter is an experimental installation of the Commonwealth Edison Company of Chicago, for studying the performance of single-conductor test cables designed for operation at 132 kv., three phase. Another important step by these committees is the development of a quality method for the grading of cables. In this method definite percentage weights are given to a large number of mechanical, electrical and thermal properties of a cable, all of which can be measured. The numerical weights are based

on the relative importance of the respective properties in the reliable functioning of the cable. The aim is that the total figure for the cable shall be an index of its probable life in service.

In independent recognition of the general importance of scientific research in the field of insulation the National Research Council, through its division of engineering and industrial research, has for some time sponsored an active committee on electrical insulation.

SUBSTANTIAL PROGRESS MADE

With all these powerful agencies concentrating on a problem, it is not surprising that substantial results have already made their appearance. Perhaps the most striking is the placing of orders by the New York Edison Company and the Commonwealth Edison Company of Chicago for cable to be operated at 132 kv. in each case. When it is remembered that up to two years ago the highest pressures used for underground cables in this country did not exceed 33 kv., these ventures take on a sensational character. The engineering achievement involved in the installation of a 132-kv. cable under ground is apparent when it is noted that the cable will be only 3 in. in diameter and will be installed in underground ducts and when comparison is made with the elaboration of tower and insulator string that is necessary for this voltage on an overhead line. The Philadelphia Electric Company has under construction a 75-kv. line, and there are others elsewhere for 66 and 44 kv. respectively. As is to be expected, radical departures from previous methods have been adopted in the case of the 132.-kv. cables.

PAPER NOW WRAPPED FLAT

But in addition to the striking innovations in these extra-high tension cables there have been many improvements all along the line, both in materials and in processes of manufacture. For example, there is a noteworthy improvement in the mechanical construction, with special reference to the smooth application of the paper tape. There is a tendency to eliminate the practice of applying the tape with a lap and to wrap it flat. This has reduced the tendency to tear, both in manufacture and during bending tests. It is stated also that more thorough impregnation results, and less likelihood of creases and the accumulation of air in pockets. Several manufacturers are introducing the use of wood pulp paper instead of manila rope fiber paper, and it is stated that the change has resulted in a noticeable increase in the dielectric strength, bringing American cable more closely into line with that manufactured in Europe. It is also stated that a good wood pulp paper can be made having twice the breakdown voltage of manila rope paper. As is well known, only a short time ago cable-impregnating compounds were found to be unstable under electric stress and to form a hard, insoluble substance in the body of the insulation. This plainly indicated the deterioration of the compound, and much study has been given to the development of compounds that will not break down into this substance. Apparently new oils have been developed which in laboratory tests will not form this substance, and claims are now being made that important improvements have resulted in cables containing the new compounds. It is also stated that these modifications will result in better mechanical properties and greater dielectric strength and that they have not affected existing low values of dielectric loss, which have been either maintained or even lowered. Important study has also been made of the thermal properties of the insulation with resulting increase in dissipative constants and current-carrying capacity.

SCIENTIFIC ASPECTS ACCENTED

Scientific research, as might be expected, has concerned itself with the underlying electrical properties of the insulating materials, both separately and in combination. In particular the nature of the dielectric losses is being studied and their variation with temperature, voltage and frequency, and beyond this, the relation of these losses to the heating and failure of the insulation. All of these questions have emphasized the probable importance of the phenomenon of dielectric absorption as an important factor in both loss and cause of breakdown. The conditions obtaining in the high-voltage cable are particularly favorable for the occurrence of dielectric absorption and also for other known causes of loss. The fact that the insulation consists of two widely different types of dielectric brought into intimate contact creates a situation which, in accordance with our best theory, must result in the presence of dielectric absorption. It is also known that absorption is an important if not a principal cause of dielectric loss.

In addition to this, when one of the constituents, the impregnating compound, is of liquid or semi-liquid form, such substances in the presence of impurities or foreign substances of any kind are known to have their normal conductivities substantially increased. In the matter of the relation of these phenomena to breakdown, a number of studies have been made abroad of the so-called pyro-electric theory of breakdown, the general tenor of which is to conclude that although this theory may obtain in the later stages of a sequence leading to certain types of breakdown, it is not generally tenable. Of particular importance is work indicating that dielectric absorption may account for the differences often observed in the dielectric strength of insulation, as related to the duration of the stress. Explanation of the variation of the dielectric strengths of the same insulation as between transient and steadily applied voltage is now apparently found.

Other work from abroad has concerned itself with the ionization and decomposition phenomena in highly stressed cable insulation. It has apparently shown that not only is entrapped air broken down or ionized, but also, as might reasonably be expected, that the impregnating compound, particularly when adjacent to entrapped air, is subject to rapid decomposition. In all probability these phenomena are the fundamental causes of the well-known break in the power factor-voltage curve of high-voltage cables. There is distinct suggestion that above the break in this curve the processes of deterioration are in active operation all the time, and a limiting life of the cable is thus automatically set. This limit of life may vary from one cable to another, but the obvious conclusion is that for indefinite life, cable insulation should not be operated above the critical value of electric stress. Unfortunately these critical stresses are at present quite low and most high-voltage cables operate well above them.

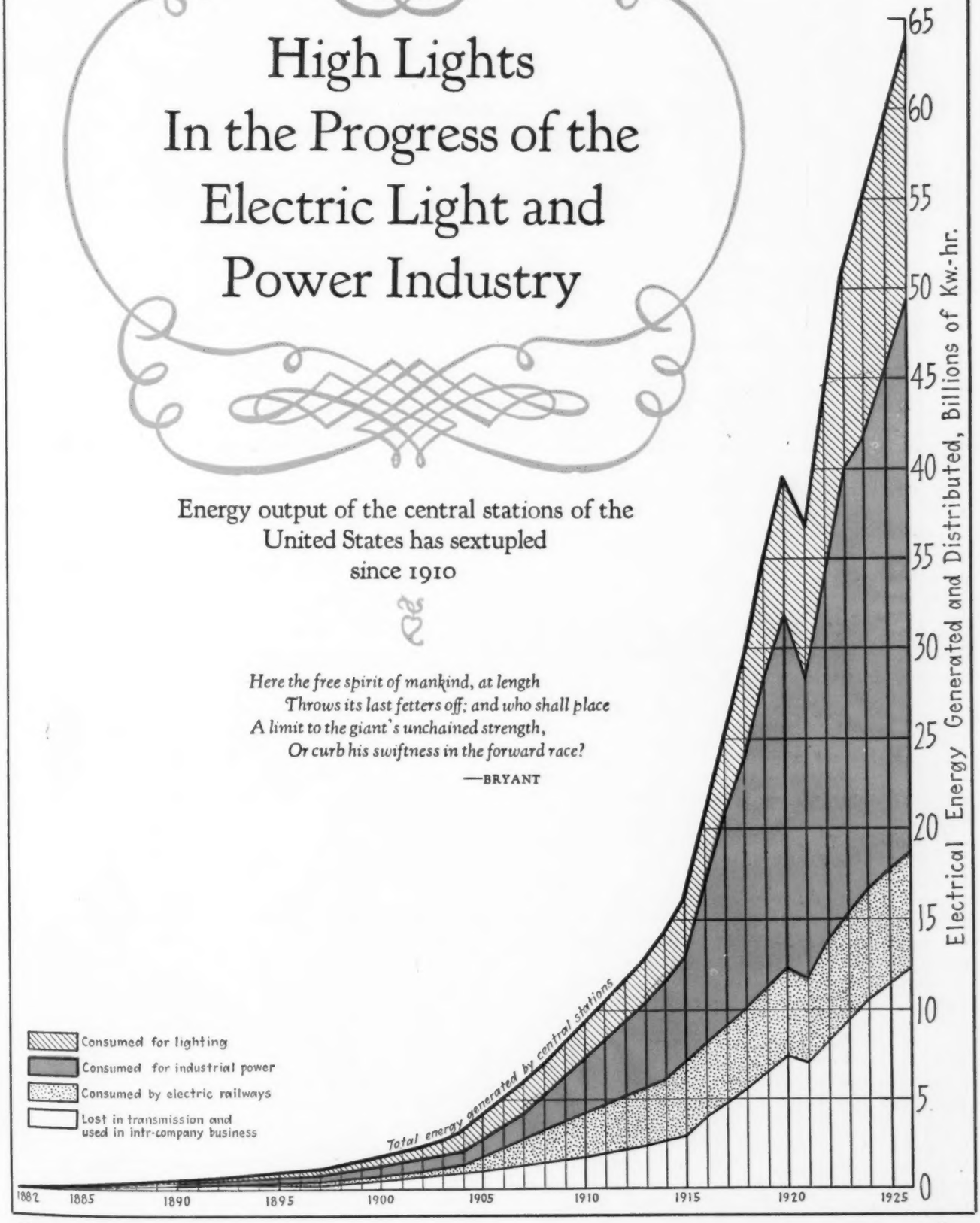
It is certain, however, that continued activity and study of the materials and methods of assembly will result in the continued increase of the inherent critical ionization values of stress, thus also approaching more nearly the ideal conditions of long life.

High Lights In the Progress of the Electric Light and Power Industry

Energy output of the central stations of the United States has sextupled since 1910

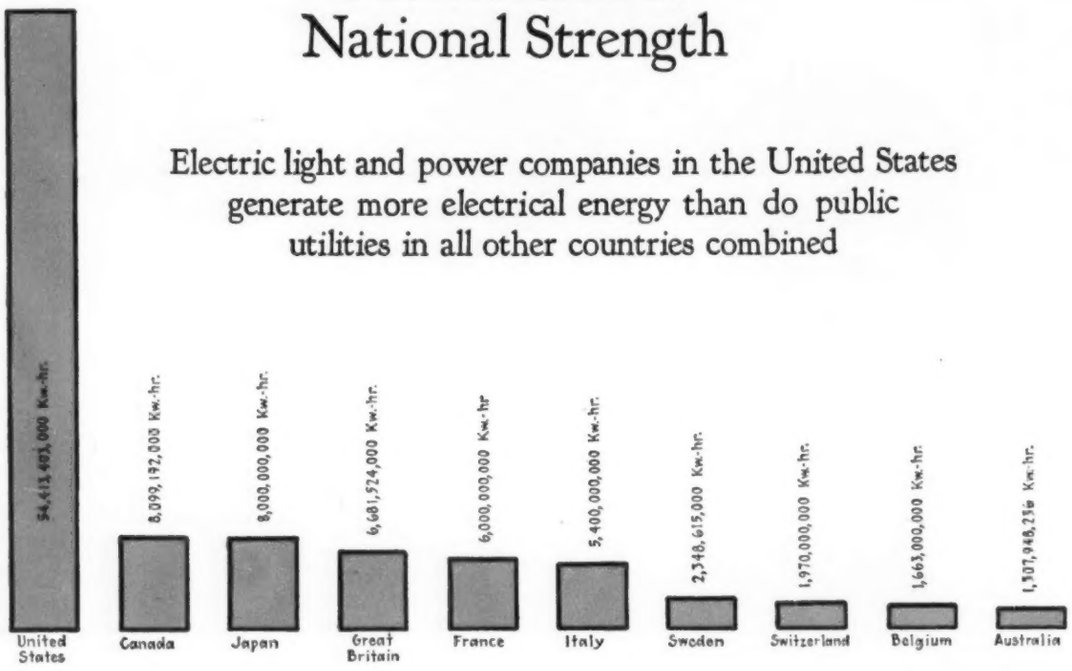
Here the free spirit of mankind, at length
Throws its last fetters off; and who shall place
A limit to the giant's unchained strength,
Or curb his swiftness in the forward race?

—BRYANT



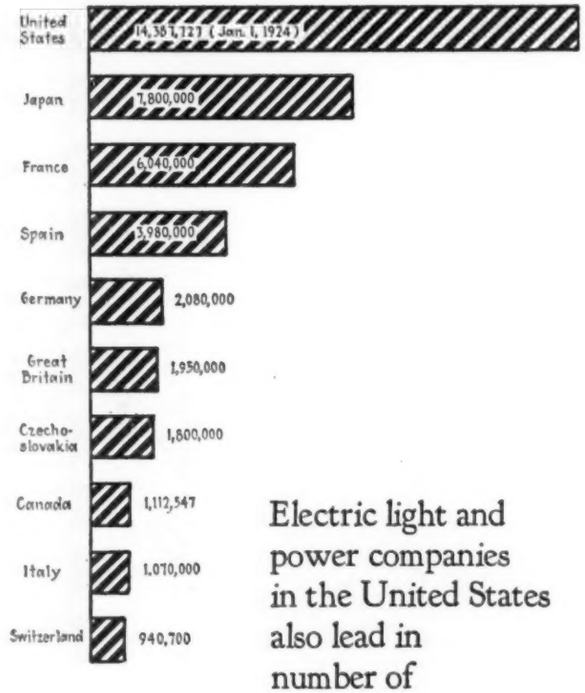
Electrical Production a Reflection of National Strength

Electric light and power companies in the United States generate more electrical energy than do public utilities in all other countries combined



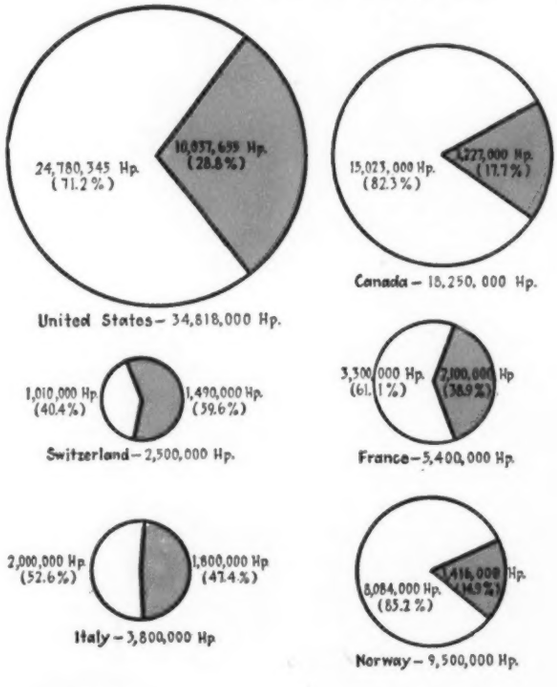
No data received on central station operations in Germany

All data for year 1924



Electric light and power companies in the United States also lead in number of customers served

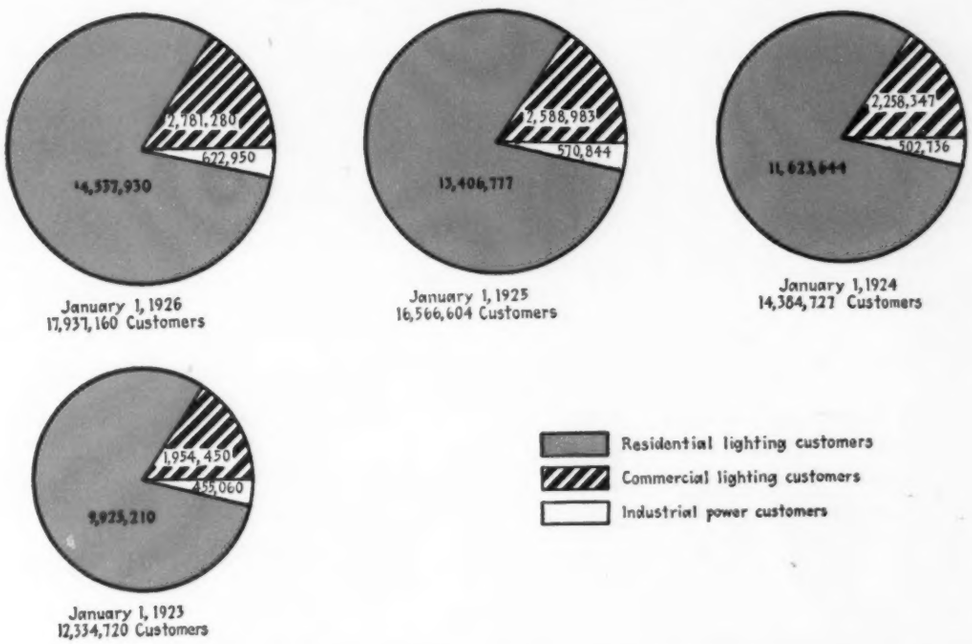
The United States leads the world in water-power development

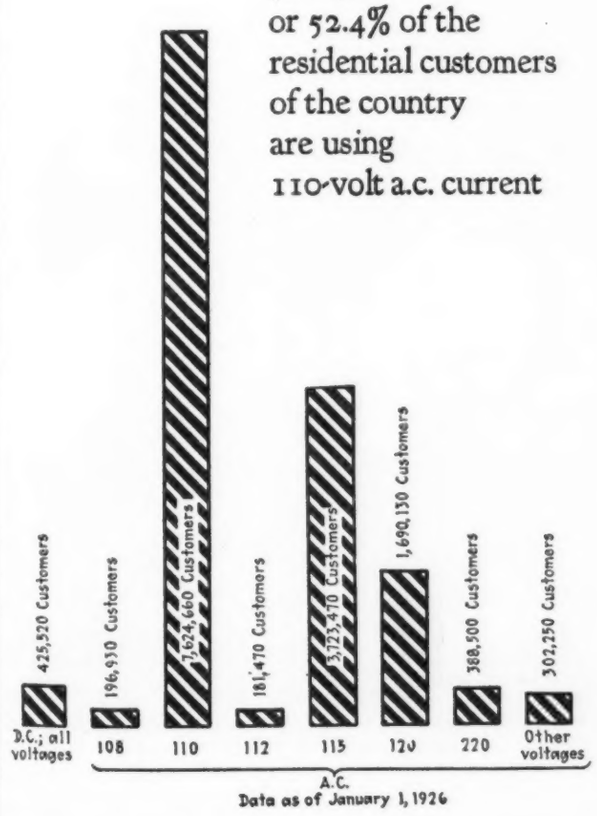


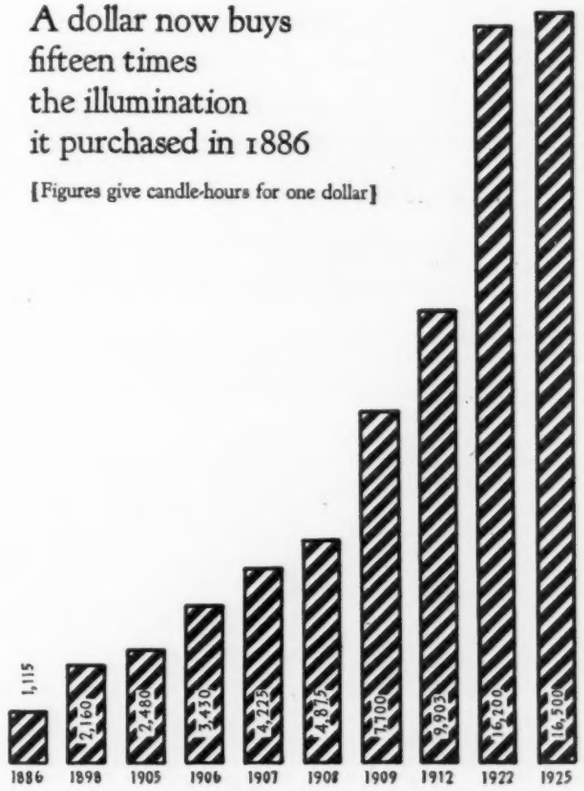
Data on potential water power show the power available 90 per cent of the time at 70 per cent efficiency

Electricity an Essential of the Modern Home

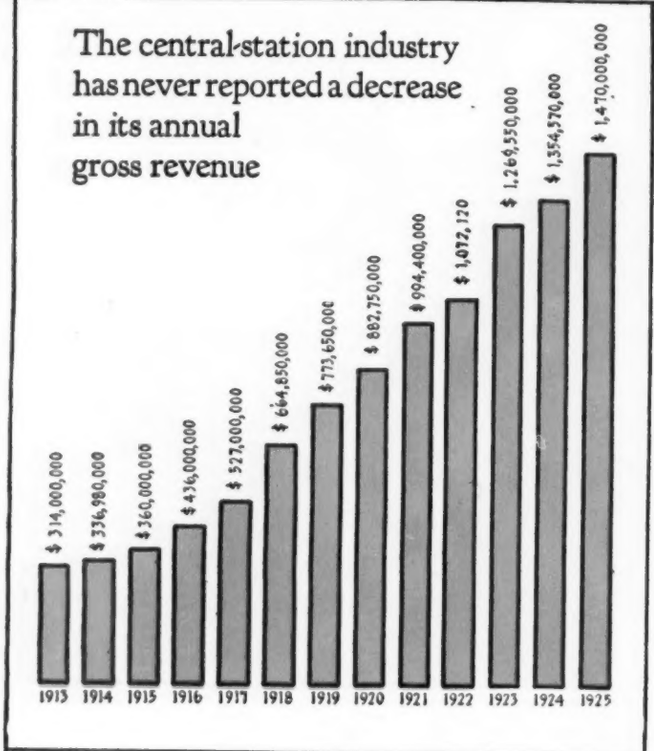
63,100,000 or 54.4% of the people in the United States are now living in electrically lighted dwellings

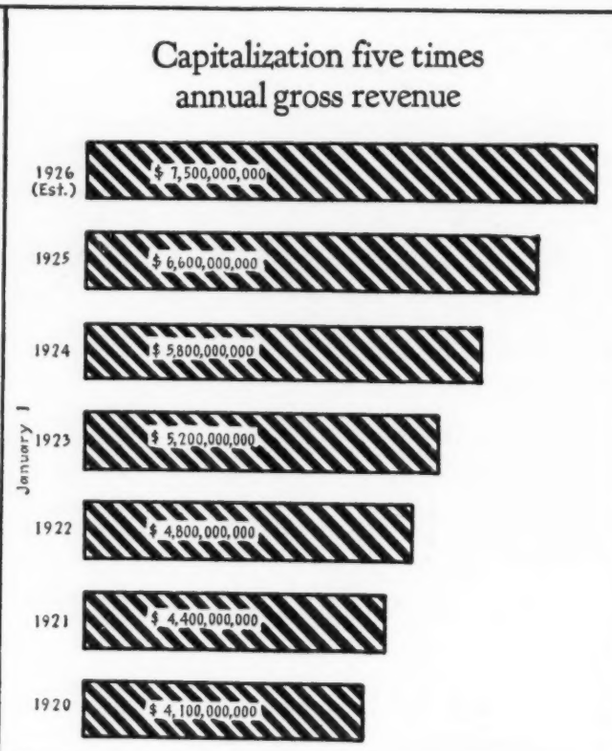


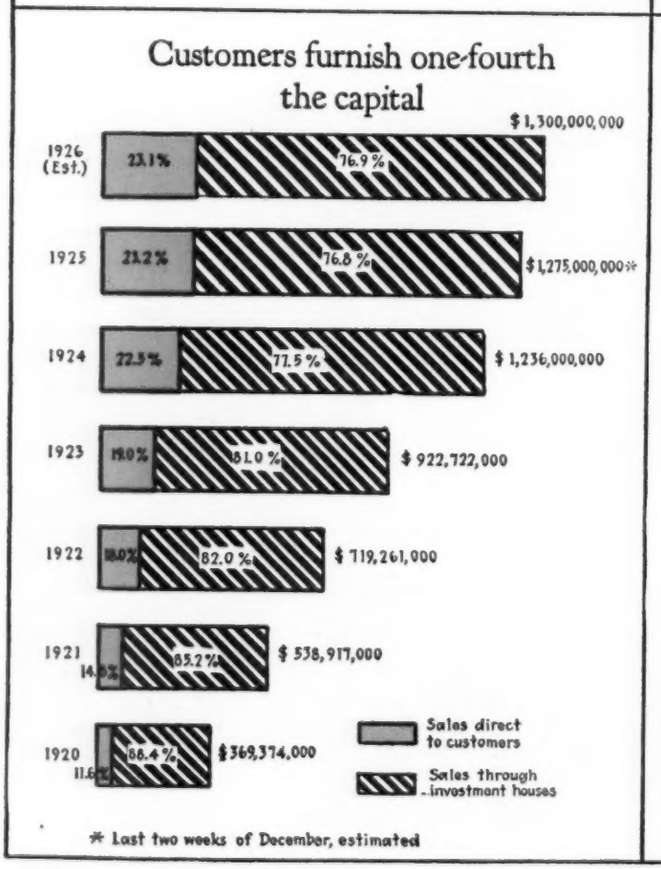


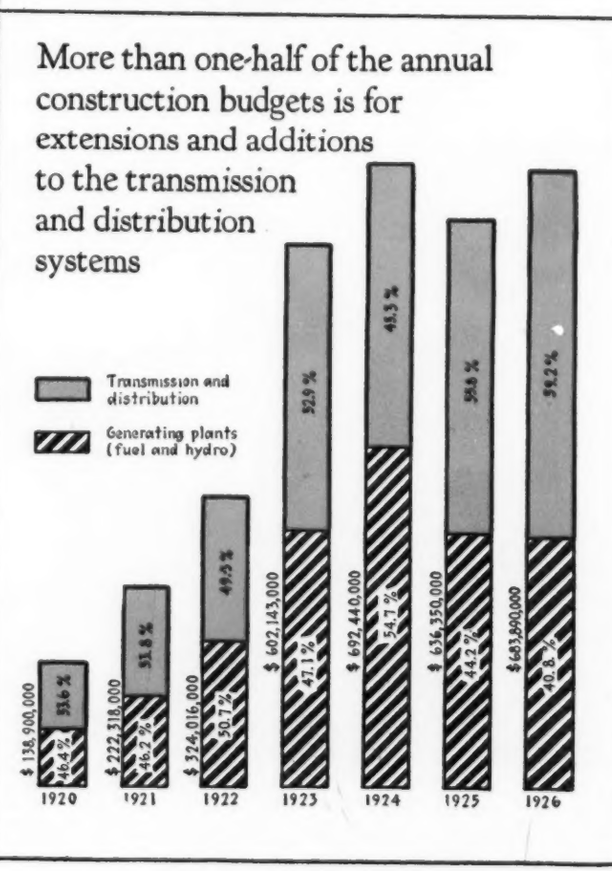


The Central-Station Industry Has Risen to a High Plane in the World of Finance

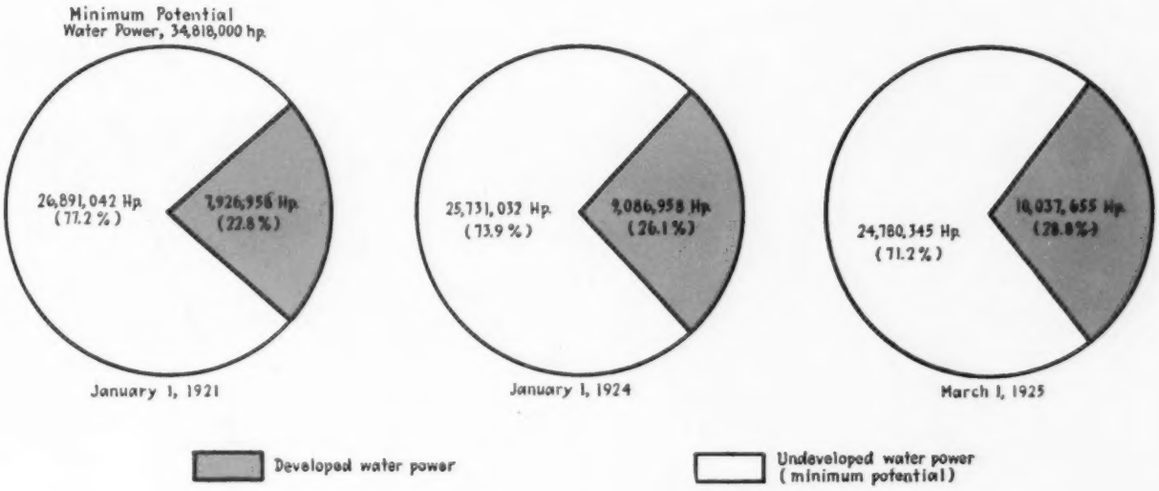




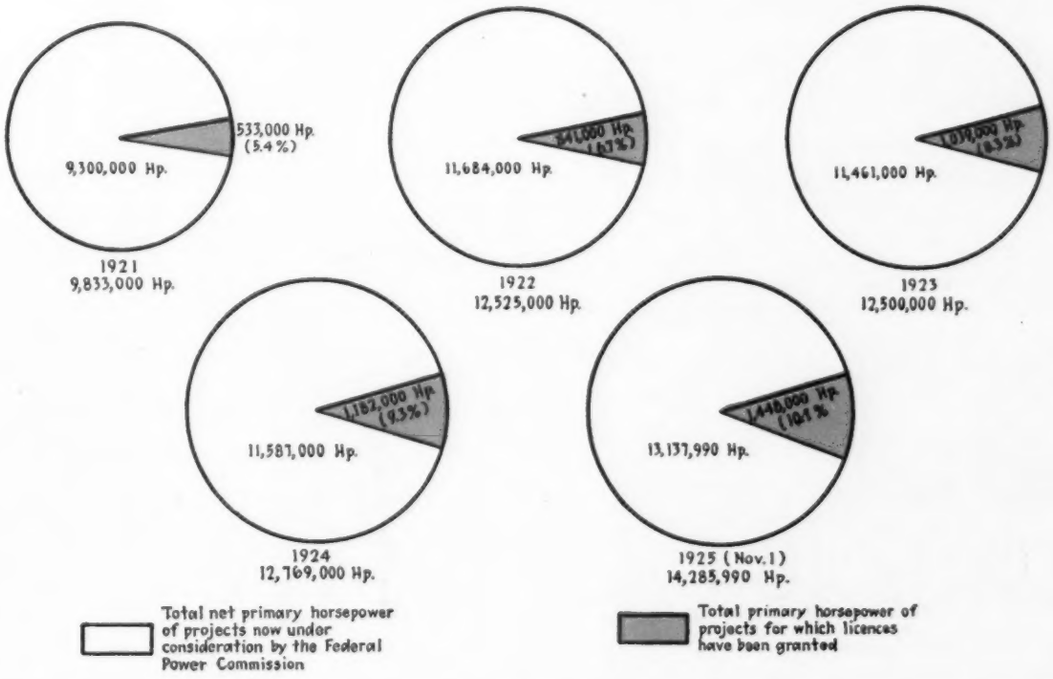



More than one-half of the annual construction budgets is for extensions and additions to the transmission and distribution systems
Transmission and distribution
Generating plants (fuel and hydro)
$ 138,900,000 53.6% 46.4%
$ 222,318,000 53.8% 46.2%
$ 324,016,000 49.3% 50.7%
$ 602,143,000 52.9% 47.1%
$ 692,440,000 45.3% 54.7%
$ 636,350,000 55.8% 44.2%
$ 603,890,000 59.2% 40.8%
1920 1921 1922 1923 1924 1925 1926

A Sane Development of the Nation's Water Powers Is Now Being Achieved

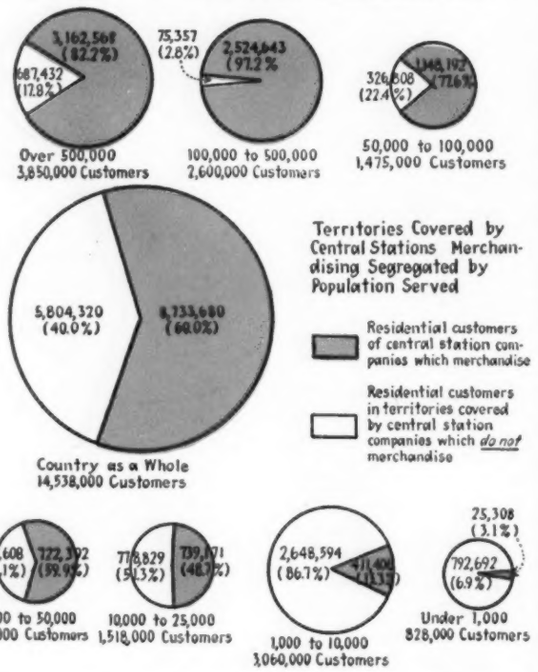


During the five years of its existence the Federal Power Commission has received 669 applications for hydro-electric projects involving a total of 21,311,699 primary horsepower and an ultimate installation of 36,120,476 horsepower.

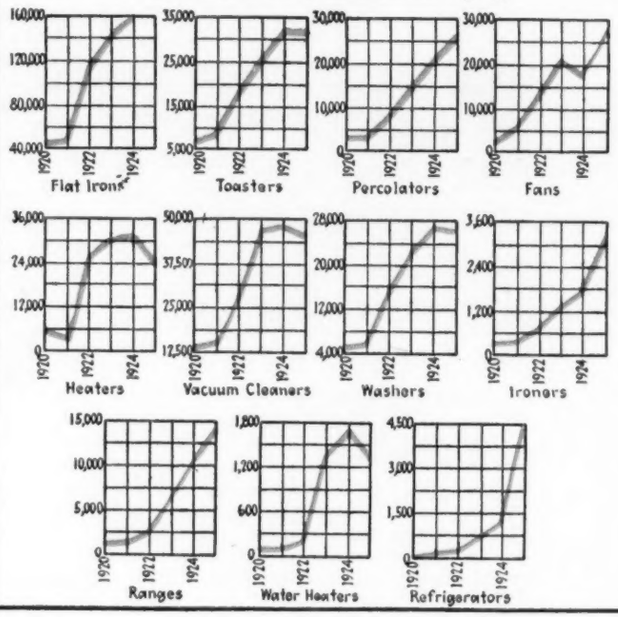


Appliance Sales a Natural Central-Station Function

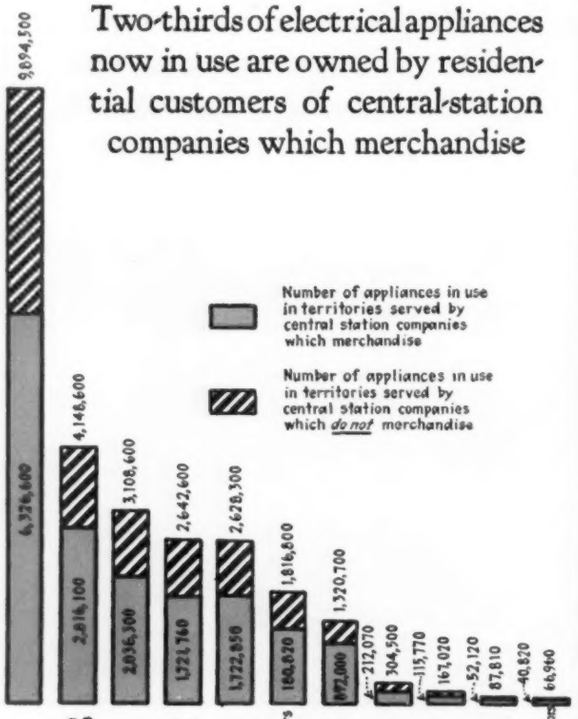
2,644 central stations merchandise



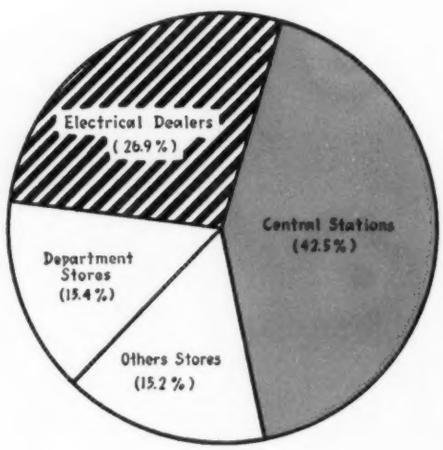
Number of appliances sold by 132 central-station companies serving 3,194,935 residential customers in 1925



Two-thirds of electrical appliances now in use are owned by residential customers of central-station companies which merchandise



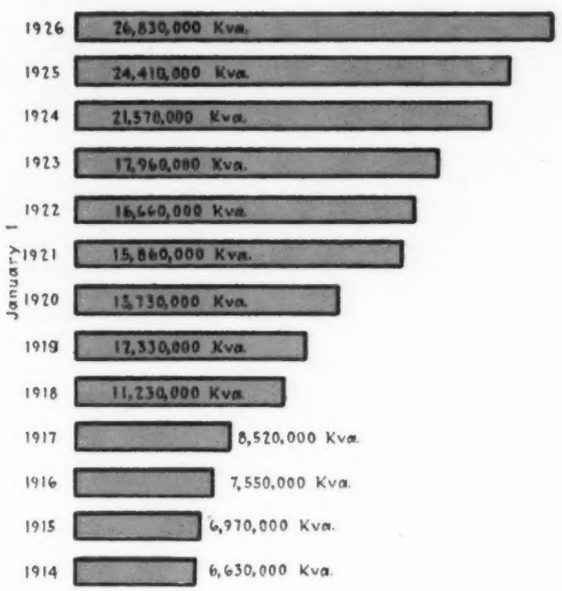
In the country as a whole central stations which merchandise sell 42.5% of the electrical appliances sold in their territory



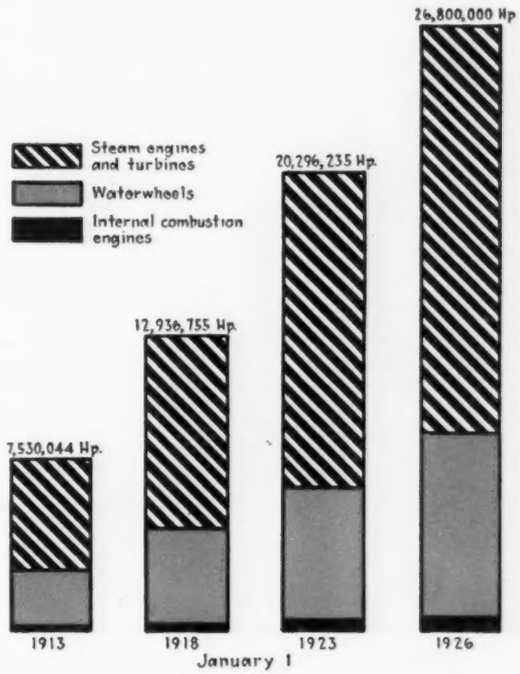
Data for Year 1924

The Generating Plant Is the Heart of the Electrical System

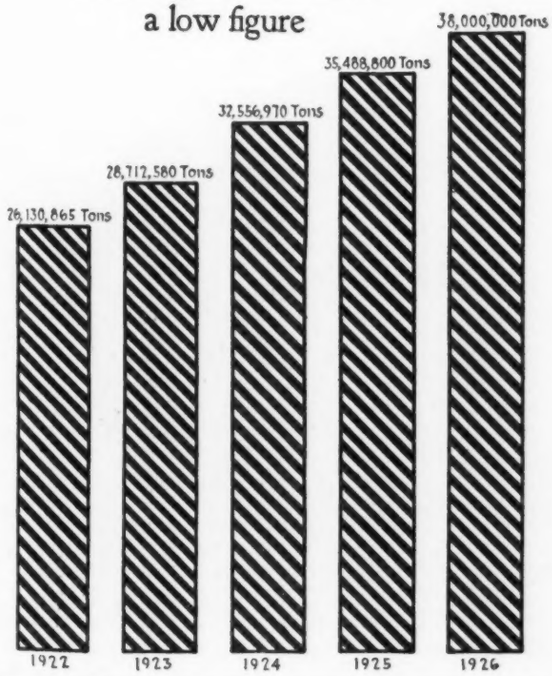
The generator rating in central stations has quadrupled since 1914



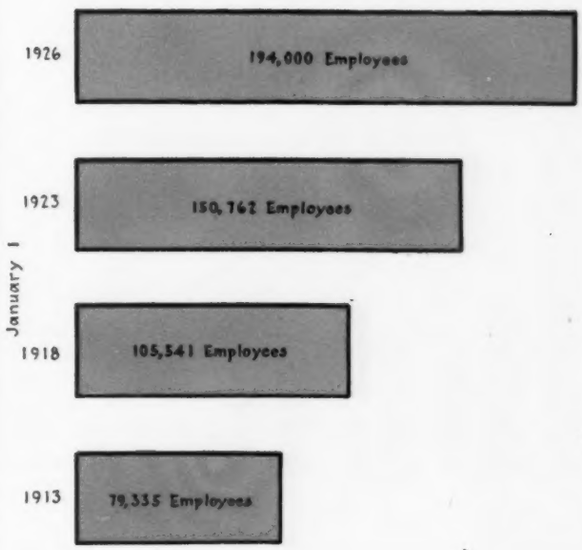
Steam drive predominates in the central-station power plants



Increased efficiency has held the consumption of coal to a low figure

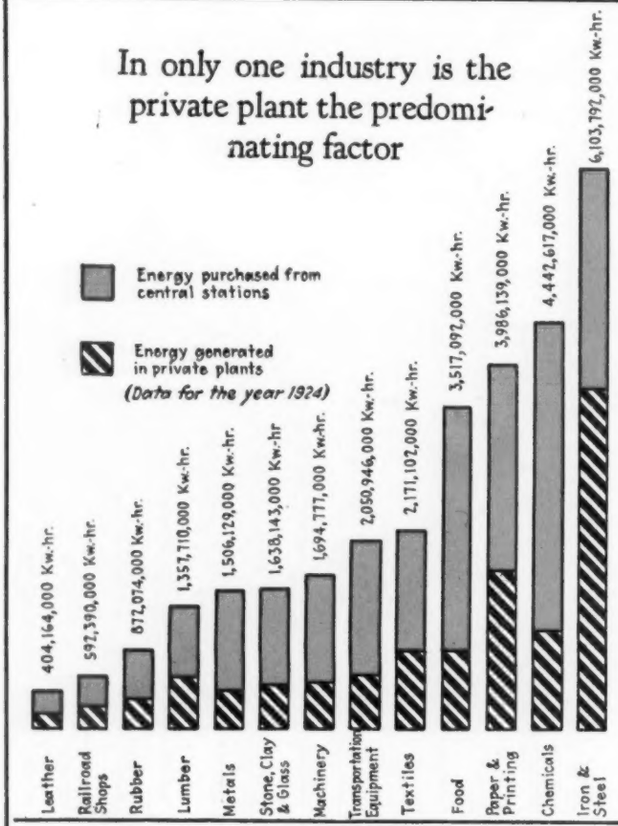


The number of central-station employees has only tripled since 1910, while the energy output has sextupled

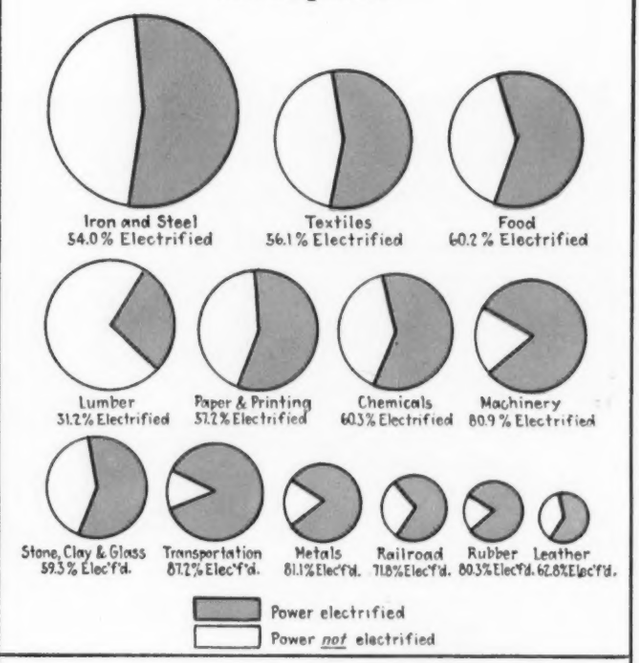


Electric Power Vitalizes American Industry

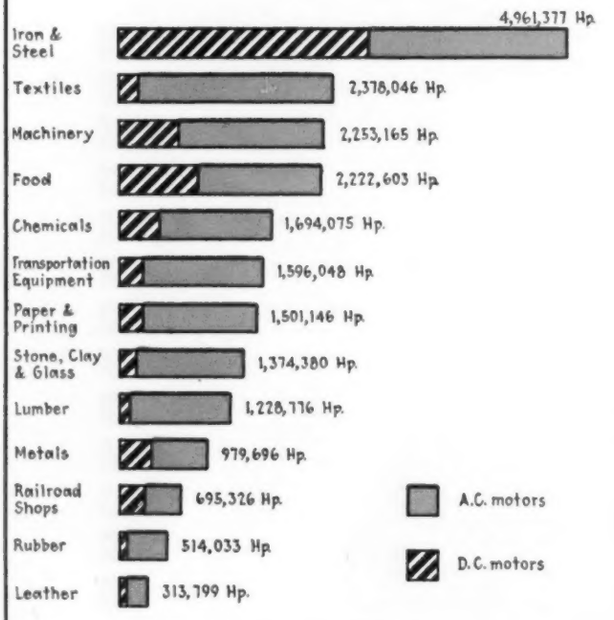
In only one industry is the private plant the predominating factor



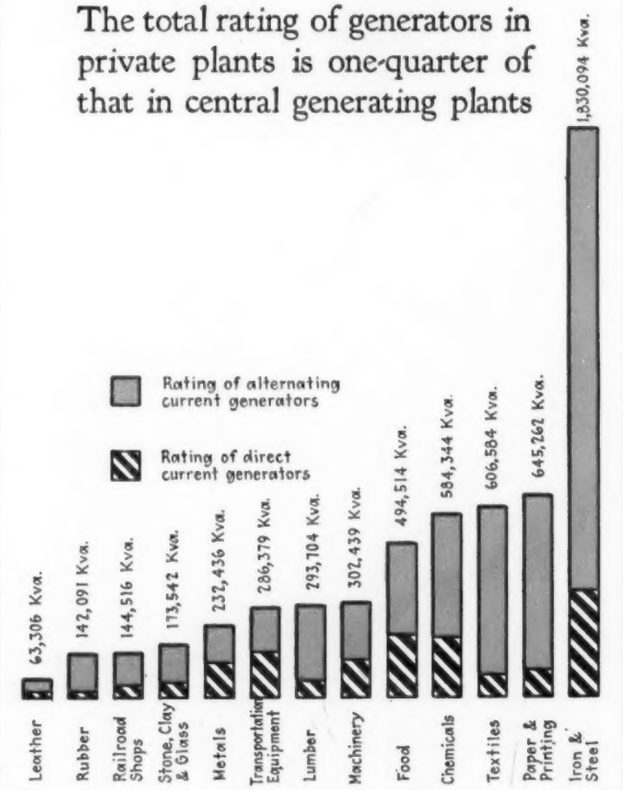
A large potential industry power field still remains for future development



Almost one-third the total motor rating is in direct-current machines



The total rating of generators in private plants is one-quarter of that in central generating plants



Developments in Electrical Apparatus

Utility Systems and Their Developments Are Outlined and the Status of Apparatus for Use on These Systems Is Surveyed —New Developments of the Year Are Indicated

By E. C. STONE
Chairman Electrical Apparatus Committee N.E.L.A.

OUTSTANDING during the past year has been the attention which engineers have focused on the study of the design and operation of the system as a whole. The entire system from generating stations to customer's meter has been given careful attention, with a view to obtaining the highest degree of economy and reliability of service for the consumer of electric power. Large additions to the generating capacity of practically all systems and interconnections between many of them, as a result of which greater total generating capacity and greater mileages of transmission lines than ever before are now operating in parallel as unified systems, have made imperative careful studies of the transmission system.

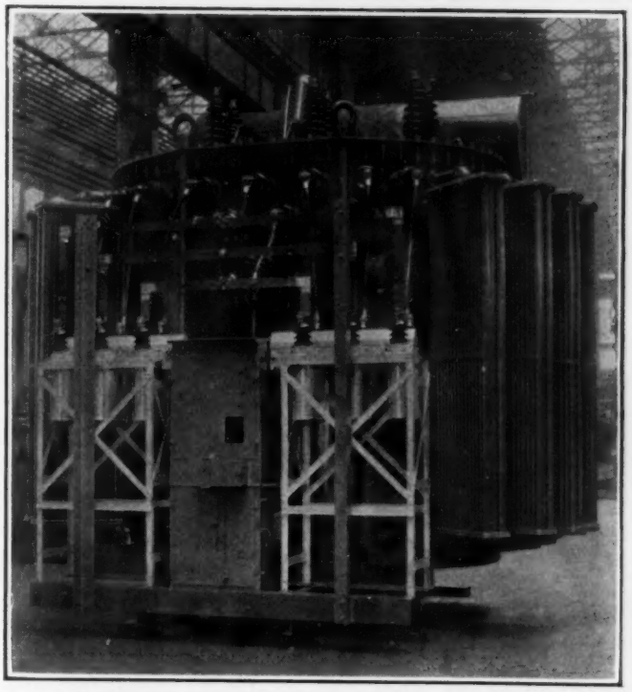
Operating engineers are also coming to the conclusion that the best insurance against failures is systematic and adequate maintenance of all parts and systems are now being set up so that any piece of apparatus or any line may be taken out of service periodically for inspection and maintenance. Conditions as to system stability also directly affect the scheme of connection to be adopted. This problem deals not only with holding all prime movers of the system in service and in synchronism at all times, but also with the prevention of shutdown to rotary converters and other synchronous apparatus at times of system disturbance.

Studies on the distribution end of the system have been in the direction of the systematic development of feeders, mains and networks, simplification of substation layouts, or complete elimination of substations, and the development of a universal low-voltage alternating-current system that will do in the alternating-current field what the Edison system has done in the direct-current field.

The high cost of substations, due chiefly to the heavy duty switching equipment and ruggedness of construction required because of the heavy concentration of power that may occur from an insulation failure, is resulting in much attention being given to possibility of eliminating them entirely.

Substation Design Changes

In substations simplicity and ruggedness of design are emphasized, but with due regard to facilities for proper maintenance of all live parts and equipment in the station. On account of the great cost of high interrupting capacity breakers, the minimum possible amount of high-tension switching and bus structure is used in the new designs. Each breaker installed must justify its cost by performing a definite function. Reasonable sectionalizing of high and low-voltage buses is customary and the sections are isolated so that trouble in one section will affect only that section and will not spread to and shut down the rest of the station. In a number of stations steel compartments are used instead of concrete or brick and offer the definite advantage of a high conducting path to ground for dissipation of the arc energy involved in a flashover. In some recent designs busbars are isolated from one another by the use of heavy flame-proof insulation wrapped around each individual busbar, instead of placing each in a separate fireproof cell. This arrangement is expected to prevent the extensive generation of conducting gases in case of a flashover. Truck breakers, built in units that are completely assembled in the factory and shipped ready to install, are becoming more popular.



AN AUTO-TRANSFORMER WITH RATIO CONTROL DESIGNED FOR INSTALLATION ON A TIE LINE BETWEEN THE SYSTEMS OF THE DUQUESNE LIGHT COMPANY AND THE WEST PENN POWER COMPANY (GENERAL ELECTRIC)

Complete automatic alternating-current substations as well as direct-current substations are coming into more general use every day, and the control equipment for them is being rapidly improved. In many cases, although the station is full automatic, it is found desirable to install a remote indication that will give the system operator information when breakers open. An extensive application of carrier current control of automatic substations has been adopted by one large system. Important advances have also been made in remote metering by means of Telemetering apparatus.

A standard operating duty has been tentatively

adopted for circuit breakers in automatic substations. This consists of four unit operating cycles with the first, second and third reclosures, each delayed by 15, 30 and 75 seconds respectively.

Because of its very high cost per kilovolt-ampere, the use of series street-lighting equipment is being omitted from new substations. The present trend is definitely toward the use of incandescent street lamps fed by pole type regulating transformers.

More and more attention is being given to the safety features of electrical installations both in power plants and substations. During the past year particular attention has been given to suitable interlocking between

POWER-FACTOR CORRECTION ACTIVE

All utilities have been studying the power-factor situation seriously during the past year. Electrical manufacturers have built several types of corrective equipment which have operated successfully. The view above shows an 840-kva. static condenser installation of the Westinghouse company in operation in a steel mill.

disconnecting switches and oil circuit breakers, and between other kinds of apparatus where operation in definite sequence is necessary to safety.

New Developments

Turning to the apparatus itself, no new types or radical modifications of old types have appeared during the past year. The development rather has been in the direction of units of larger capacity and refinements in design, which make for greater economy and reliability. The largest single turbo-generator installed during the year was rated at 62,500 kva. It is a 1,200-r.p.m. machine, self-ventilated. At the present time an 80,000-kw. turbine generator unit is under construction, but this will be a cross compound unit of two 40,000-kw. machines. The largest frequency changer put in service to date is a 40,000-kva., 600-r.p.m., 11,500-volt unit. A 40,000-kva., 300-r.p.m. frequency changer is under construction, on which the 60-cycle end will have provisions for frame shifting under load. The cooling will be by the closed ventilating system.

A vibration absorber for large single-phase machines has been devised to prevent damage from pulsating torque. This consists of a spring support for the entire stator and frame of the unit, which prevents transmission of stator vibrations to the supporting foundations and eliminates vibration in the surrounding structure. This development has removed what was becoming a serious limitation to the size of single-phase generators.

Mercury rectifiers for heavy power duty are receiving considerable attention, and a number of installations have been made or were under construction during the past year. One of these is for 230/115-volt Edison direct-current service, several are for 600-volt railway service, and one or two are for 1,500-volt railway service.

Transformers larger than any heretofore built are under construction at the present time. Among these are a 220-kv., 25,000-kva., single-phase unit cooled by forced oil circulation and a 132-kv., 31,400-kva., single-phase water-cooled unit. A 132-kv., 25,000-kva., three-phase self-cooled unit under construction is the largest of its type. In order to prevent oxidation of oil and resultant sludging, the best practice requires the use of oil conservators on transformers or the filling of the air space in the tank above the oil with nitrogen. The need for a voltage regulator on interconnected systems where power plants having considerable distance are operated in parallel has led to the development of various types of apparatus for changing transformer taps or regulating voltage under load. Some of these methods employ a bank of oil circuit breakers connected to the various taps and interlocked to avoid short circuiting of any portion of the transformer windings. Another method makes use of an external regulator of relatively small capacity and a suitable controller driven by a motor so arranged so as to transfer the regulator from tap to tap.

Oil Breaker Improvements

Definite advances have been made during the year in the design of oil circuit breakers. These have been greatly accelerated by the field tests made on the systems of a number of the larger operating companies. Some of these tests were made at a calculated power concentration of 725,000 kva. at 132 kv., thereby exceeding in both capacity and voltage the values of all previous tests. Much attention has been given to increase in speed of breaking the arc, since the energy to be dissipated in the breaker depends directly on this factor. Explosion chambers, high-speed contacts and multiple-series breaks are recommended by the various manufacturers for accomplishing this purpose. Active attention is also being given to prevention of or protection against the destructive secondary explotion of gas in the breaker after the current interruption has been completed. A high-speed, 11,000-volt, single-pole oil breaker has been developed capable of interrupting a short circuit in one cycle. High-speed direct-current breakers, which will interrupt a feeder short circuit before the rotary converters feeding the short can flash over, are in satisfactory operation in a number of installations.

European manufacturers who have entered the American field during the past year have introduced several novel features in oil circuit breaker designs. One of these is the multiple-break contact, with ten or more breaks in series on high-voltage circuit breakers. Another is a design by means of which a third contact in each pole introduces a high resistance into the arc path, thus reducing the recovery voltage across the main contacts and facilitating the breaking of the arc. It is claimed that on medium voltages this device will increase the interrupting capacity of the breaker to almost three times its normal value.

Another European type of equipment of interest is the so-called metal-clad switchgear. This switchgear

is built in single switch units, which include oil circuit breaker, busbars, disconnecting switches, instrument transformers and cable heads. All live conductors are immersed in oil or solidly imbedded in insulating compound inclosed in metal covering.

Great improvements have also been made in fuses during the past year. The best designs available today for practically all voltages and for surprisingly high interrupting capacities may be used with a considerable degree of confidence. This situation is bound to increase the field of application for fuses, and their use will expand as their reliability increases. Selective operation among a number of fuses in series in a circuit may soon become practicable.

Marked advances have also been made in air break switches. These have been in the direction of greater electrical and mechanical strength, more positive operating mechanism and better contact design. The performance in service from the latest designs should be much better than formerly, and less maintenance should be required. Nevertheless the ability of these switches to interrupt current is still limited and very sensitive to wind conditions. Although tests on 23,000-volt circuits have indicated interrupting capacities of 10,000 kva. where the phases of the switch are sufficiently separated and there is no wind, this capacity would be radically reduced in the presence of wind. The availability of motor-driven operating mechanisms and automatic overload trip devices further adds to the usefulness of this type of switch.

Current-limiting reactors are now in satisfactory operation on voltages up to 27,000 and can be built for voltages up to 70,000. Their use at the higher voltages is quite possible in connection with stabilizing transmission networks. Some outdoor installations at 22,000 volts are in satisfactory service.

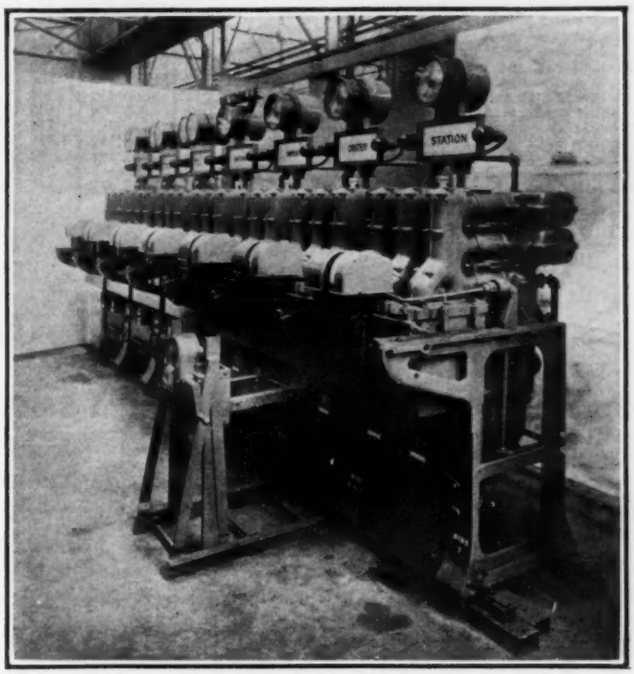
Advances have been made in the study of lightning conditions and in lightning protection. Much has been learned through the experimental data obtained from records taken by the klydonograph. During the past season at least one large transmission system operating at 132 kv. without lightning protection suffered a very large number of breakdowns from lightning, thus demonstrating that systems of this voltage are not sufficiently insulated to withstand lightning voltages. This system will be fully protected before the next lightning season. The overhead ground wire is still a subject of argument. Laboratory experiments have shown very definitely that ground wires materially reduce induced voltages from lightning. In practice there is a trend toward continuing the use of the ground wire on steel tower construction, but some engineers contend that with wood pole construction the overhead ground wire reduces the flashover value of the line as much as it reduces the induced voltage.

Lightning protection for distribution networks operating under 7,000 volts as obtained from the high discharge capacity types of arrester is proving quite satisfactory. On higher voltages, however, the situation is not so good.

Relays Give Good Results

Protective relays have given better results in the past year than ever before. Differential systems for the protection of machines have been developed to a very high degree of sensitiveness. On the other hand, the selective timing systems that have been so generally developed are reaching their definite limits in the modern transmission networks and larger capacity syctems. In large systems it is very desirable, if not absolutely essential, that all faults be very promptly isolated, in order to limit damage to equipment and service by fault energy. On such systems relay settings of two or three seconds such as have been used in the past may be extremely undesirable. Some method other than difference in time seems to be a fundamental requirement for the relaying of the future.

A number of improvements in motors have been made. Perhaps the most important is the construction



A SEVEN-UNIT ARMORED SWITCHGEAR GROUP WITH A CIRCUIT BREAKER TRUCK IN THE FOREGROUND
(ALLIS-CHALMERS, REYOLLE)

generally of induction motors for starting on full voltage, thus doing away with troublesome and complicated starting apparatus in many cases. Another of the most important developments has been the "frog leg" winding for large direct-current motors. The squirrel-cage repulsion motor brought out during the past year is a single-phase repulsion motor with a squirrel-cage winding inserted in slots located beneath the slot bearing the commuted winding. This motor gives a series characteristic for starting and a shunt running characteristic.

Problems Yet Unsolved

Even with the rapid development of the past, there are many problems yet to be solved in the design and operation of electrical apparatus. The capacity of power systems is still rapidly on the increase and the service requirements are becoming more and more exacting. In this connection the emphasis now being placed on the development of insulation, both solid insulations of the type used in generators, transformers and other electrical equipment, and liquid insulations such as oils, is of particular interest and importance. Many features of system design today are based on the assumption that there will be insulation failures and that service must not be disturbed under these conditions. At the present moment the greatest opportunity for improvements in electrical apparatus appears to be along the lines of improvements in insulation.

Table I—Distribution of the Industrial Power Load in the United States

Industry	Primary Horsepower						Electric Motors Run by Energy Generated in Private Plants, Hp.	Boilers		Number of Companies Having Private Electric Generating Plants
	Total Primary Horsepower	Owned by Establishments Reporting				Electric Motors Run by Purchased Energy, Hp.		Number	Hp.	
		Steam Engines (Not Turbines)	Steam Turbines	Internal-Combustion Engines	Water Turbines					
All industries	33,143,753	13,386,996	3,340,204	1,254,140	1,803,317	13,359,096	8,888,569	60,192	16,069,113	8,157
Chemicals and allied products	2,738,605	1,060,992	410,660	78,877	168,557	1,019,519	674,556	7,390	2,168,454	664
Food and kindred products	3,723,130	1,586,547	123,719	182,386	120,912	1,709,566	513,037	9,428	2,229,858	1,627
Iron and steel and their products, not including m.. chinery	7,243,340	3,629,067	1,047,810	613,724	21,190	1,931,549	3,029,828	9,645	3,602,405	670
Leather and its finished products	412,961	172,329	41,722	4,256	3,884	190,770	123,029	1,406	278,705	259
Lumber and allied products	3,336,333	2,336,854	186,575	48,711	42,746	721,447	507,329	11,950	2,384,769	1,045
Machinery	2,267,185	442,383	216,403	69,064	26,522	1,512,813	740,352	2,577	613,285	746
Metals and metal products other than iron and steel	1,168,693	299,376	138,178	23,173	11,814	696,152	283,544	969	301,094	218
Musical instruments and phonographs	90,229	35,539	16,997	743	79	36,871	39,078	359	62,994	56
Paper and printing	2,742,693	798,571	194,409	15,186	886,462	848,065	653,081	2,365	774,599	576
Railroad repair shops	806,435	306,195	52,873	23,684	88	423,595	271,731	1,898	472,208	275
Rubber products	605,634	135,338	121,697	8,859	6,506	333,234	180,799	497	221,687	86
Stone, clay, and glass and their products	1,919,235	729,529	117,650	92,090	30,582	949,384	424,996	3,066	798,212	555
Textiles and their products	3,800,360	1,379,328	457,772	30,112	466,364	1,466,784	911,262	6,029	1,481,865	978
Tobacco manufactures	43,481	22,587	4,574	417	0	15,903	15,254	254	41,971	44
Transportation equipment, air, land and water	1,667,968	295,405	169,057	50,490	10,940	1,142,076	453,972	969	403,466	182
Miscellaneous industries	577,471	156,956	40,108	12,368	6,671	361,368	66,721	1,390	233,541	176

Industrial Load of the United States

Potential Industrial Field of Central Stations Only 44.0 per Cent Developed — Rating of Generators in Private Plants Totals 5,913,462 Kva.—Mountain-Pacific States Lead in Degree of Industrial Electrification

By R. M. DAVIS
Statistical Editor ELECTRICAL WORLD

DURING the ten-year period 1913 to 1924 the output of the electric light and power industry was more than quadrupled and the revenue rose from $320,000,000 to $1,354,000,000, an increase of 323 per cent. In fact, more than three-quarters of the total growth of this great industry has taken place since 1913. The distribution of the energy sold by the industry has not been one-sided. The lighting load increased from 2,800,000,000 kw.-hr. in 1913 to 12,600,000,000 kw.-hr. in 1924, the power load increased from 4,400,000,000 kw.-hr. to 25,092,873,000 kw.-hr. and the electric railway load of the central stations increased from 3,300,000,000 kw.-hr. to 6,200,530,000 kw.-hr. And the end is not yet, nor has the peak of operations appeared on the horizon.

In order to gain a clear picture of the present status of the industrial electric load of the United States from the standpoint of both central-station generation and private generation of power, a nation-wide survey was initiated by the ELECTRICAL WORLD at the opening of

Table II—Distribution of the Industrial Power Load in New England as of

Industry	Number of Establishments Reporting Power	Primary Horsepower					Electric Motors Run by Energy Generated in Private Plants, Hp.	Boilers		Number of Companies Having Private Electric Generating Plants	Estimated Rating of Prime Movers Used in Private Generating Plants, Hp.	Estimated Electrification of Industry, Per Cent
		Total Primary Horsepower	Owned by Establishments Reporting			Electric Motors Run by Purchased Energy, Hp.		Number	Hp.			
			Steam Engines (Not Turbines)	Steam Turbines	Internal-Combustion Engines	Water Turbines						
All industries	17,531	4,151,136	1,284,656	493,157	46,933	761,211	1,564,728	1,102,423	6,118	1,483,620	1,038	845,805	58.2
Chemicals and allied products	634	112,765	36,910	22,016	3,059	3,433	46,840	29,274	288	72,150	37	16,651	56.4
Food and kindred products	3,561	123,001	40,085	2,977	2,328	6,244	71,367	18,752	152	54,920	68	14,857	70.1
Iron and steel and their products, not including machinery	514	264,499	81,186	26,972	2,947	10,207	143,187	47,409	341	69,390	61	56,121	75.3
Leather and its finished products	1,110	112,819	35,528	7,546	295	1,565	67,885	18,555	110	26,325	48	13,026	71.1
Lumber and allied products	2,096	197,508	116,371	2,161	3,539	20,890	54,547	22,437	909	132,000	95	12,205	33.8
Machinery	1,342	340,396	69,271	43,752	4,553	10,985	211,835	153,977	213	76,567	99	65,959	81.6
Metals and metal products other than iron and steel	972	208,158	37,292	33,640	729	4,950	131,547	70,126	157	48,820	44	55,080	89.7
Miscellaneous industries	713	54,189	13,853	4,037	725	3,059	31,915	6,282	96	9,549	26	8,105	73.9
Musical instruments and phonographs	69	15,233	6,192	427	8	45	8,561	2,411	12	4,723	6	2,025	65.6
Paper and printing	2,209	720,742	156,722	48,764	5,307	370,829	139,120	171,340	821	207,050	104	230,352	59.4
Railroad repair shops	89	26,908	8,930	1,264	87	0	16,627	8,330	44	11,547	8	5,274	81.5
Rubber products	69	146,659	32,660	7,449	8,522	1,510	96,518	23,097	105	55,150	17	23,320	81.3
Stone, clay, and glass products	771	112,609	27,102	1,857	1,939	13,727	68,040	16,631	145	21,723	20	5,908	61.7
Textiles and their products	1,964	1,659,831	610,983	289,120	12,383	312,235	435,110	506,163	2,696	685,470	385	328,370	46.7
Tobacco manufactures	416	435	30	0	207	0	198	3	1	56	1	9	47.0
Transportation equipment, air, land and water	1,002	55,384	11,541	1,175	305	932	41,431	7,636	28	8,180	19	8,543	90.3

as of January 1, 1924, and Energy Consumed by Industrial Plants During 1924

Estimated Rating of Prime Movers Used in Private Generating Plants, Hp.	Estimated Electrification of Industry Per Cent	Energy Consumed			Generators in Private Plants			A.C. Motors		D.C. Motors		Motors Under 5 Hp.	
		Total Energy Consumed, Kw.-Hr.	Purchased from Central Stations, Kw.-Hr.	Generated in Private Plants, Kw.-Hr.	Total Rating of Generators, Kva.	Rating of A.C. Generators, Kva.	Rating of D.C. Generators, Kw.	Number	Hp.	Number	Hp.	Number	Hp.
6,416,763	59.7	31,004,483,000	19,393,722,000	11,630,761,000	5,913,462	4,411,577	1,501,885	1,176,439	15,389,566	668,298	6,858,099	989,010	2,266,441
630,803	60.3	4,442,612,000	3,379,952,000	1,062,665,000	584,344	397,896	186,448	78,898	1,251,499	77,042	442,576	87,474	240,866
534,158	60.2	3,517,092,000	2,670,520,000	846,572,000	494,514	297,635	196,879	94,070	1,347,866	106,059	874,737	109,283	282,764
1,975,344	54.0	6,103,792,000	2,393,789,000	3,710,003,000	1,830,094	1,497,778	332,316	62,394	2,200,614	122,056	2,760,763	49,340	138,686
68,462	62.8	404,164,000	243,560,000	160,604,000	63,306	36,775	26,531	21,343	221,450	11,551	92,349	16,533	46,446
317,643	31.2	1,357,710,000	777,511,000	580,199,000	293,704	243,284	50,420	81,076	1,110,787	12,536	117,989	50,207	139,478
326,802	80.9	1,694,777,000	1,190,894,000	503,883,000	302,439	184,923	117,516	150,507	1,590,097	88,864	663,068	158,896	355,560
251,173	81.1	1,506,129,000	1,095,928,000	410,201,000	232,436	117,302	115,134	60,000	627,944	36,325	351,752	47,886	116,844
29,361	73.4	57,140,000	27,940,000	29,200,000	27,173	19,306	7,867	4,992	57,768	2,245	18,181	3,824	8,528
719,154	57.2	3,986,139,000	2,262,323,000	1,723,816,000	645,262	562,441	82,821	41,270	1,245,510	29,643	255,636	31,576	76,385
156,056	71.8	592,390,000	360,079,000	232,311,000	144,516	99,525	44,991	22,904	403,179	20,051	292,167	15,433	50,285
153,360	80.3	872,074,000	558,259,000	313,815,000	142,091	124,265	17,826	68,747	440,462	5,785	73,571	49,834	119,910
188,634	59.3	1,638,143,000	1,139,421,000	498,722,000	173,542	122,782	50,760	44,776	1,183,082	25,689	191,298	32,878	123,882
662,882	56.1	2,171,102,000	1,322,071,000	849,031,000	606,584	542,402	64,182	282,705	2,162,697	51,507	215,349	229,125	339,247
13,058	66.7	39,753,000	24,829,000	14,924,000	12,101	5,175	6,926	8,560	17,971	3,034	13,186	8,343	10,384
309,159	87.2	2,050,946,000	1,451,914,000	599,032,000	286,379	143,137	143,242	130,377	1,334,272	26,684	261,776	43,806	111,566
80,714	76.6	570,515,000	474,732,000	95,783,000	74,977	16,951	58,026	23,820	194,368	49,227	233,721	54,572	105,610

the past year. This survey covered every industrial plant of the United States using electrical energy. Acknowledgment is made of the valuable co-operation extended by the Manufacturing Division of the United States Census Bureau in making special tabulations and groupings of the most recent census data on manufactures, which official data have been used as the basis for pro-rating the returns received in the present survey to 100 per cent of the industry.

Summarized data on the use of electrical energy in the various sections of the country by the various industries arranged under sixteen groups according to the Census Bureau classification will be found in the accompanying pages. Lack of space makes it impossible to publish the detailed state data in these columns, but the state figures will be issued in pamphlet form and will be sent to anyone upon request.

The ELECTRICAL WORLD conducted a similar survey of the industrial load of the United States during 1920, 1921 and 1922, the results of which were published in the January 6, 1923, issue of ELECTRICAL WORLD. In making any comparison between the results of the present survey and those obtained in the first survey, it must be remembered that the grouping of industries has been materially altered; the first survey also included mining, irrigation and other miscellaneous uses of energy for power purposes. No direct comparison therefore can be drawn between the data contained in the two surveys.

The results of the present survey indicate that American industry is far from saturated electrically. In spite of the marvelous growth in the power load of the central stations during the past ten years and the growth recorded in private plant generation, the manufacturing plants of the country are today only 65.0 per cent electrified. This degree of electrification includes electrification from private generating plants as well as from central stations. The figure of 65.0 per cent does not indicate, therefore, the extent to which the central station has penetrated the potential industrial field. Approximately 32.4 per cent of the industrial electrical load of the country is supplied from private electric-generating plants, so it may be stated that today the maximum potential industrial load of the central stations of the country has been only 44.0 per cent developed. There are, of course, certain industries that present an almost impassable barrier to complete electrification, and the private generating plant will in many instances be slow to eliminate, but the fact that almost 60 per cent of the industrial power of this

January 1, 1924, and Energy Consumed by Industrial Plants During 1924

Energy Consumed			Generators in Private Plants			A. C. Motors		D. C. Motors		Motors Under 5 Hp.		Industrial Electric Heating	
Total Energy Consumed, Kw.-Hr.	Purchased from Central Stations, Kw.-Hr.	Generated in Private Plants, Kw.-Hr.	Total Rating of Generators, Kva.	Rating of A. C. Generators, Kva.	Rating of D. C. Generators, Kw.	Number	Hp.	Number	Hp.	Number	Hp.	Average Monthly Load During 1924, Kw.	Energy Consumed During 1924 Kw.-Hr.
3,093,197,000	1,807,222,000	1,285,975,000	751,565	628,706	122,859	266,340	2,273,626	56,892	393,525	206,480	403,802	37,531	21,712,300
98,676,000	60,730,000	37,946,000	15,371	11,894	3,477	6,191	66,660	4,185	9,454	5,498	16,816	250	488,500
122,110,000	96,728,000	25,382,000	13,292	10,401	2,891	4,185	67,590	4,406	22,529	5,071	15,804	232	515,200
242,861,000	182,447,000	60,414,000	51,487	43,210	8,277	9,275	162,389	3,368	28,207	5,311	9,609	7,603	4,493,900
96,884,000	76,686,000	20,198,000	11,931	11,368	563	5,324	85,135	226	1,305	2,078	6,207	74	205,500
36,149,000	25,602,000	10,547,000	10,736	9,576	1,160	7,399	72,468	583	4,516	4,364	15,158	66	217,000
237,820,000	137,716,000	100,104,000	60,807	42,981	17,826	55,859	271,112	14,717	94,700	55,427	143,500	7,430	4,396,600
181,223,000	120,783,000	60,440,000	50,859	29,693	21,166	37,483	132,924	11,294	68,749	26,707	65,701	12,216	2,554,500
64,817,000	54,306,000	10,511,000	7,735	1,320	6,415	3,054	38,197	0	0	1,467	2,939	230	452,800
7,875,000	6,241,000	1,634,000	1,835	1,449	386	467	7,035	420	3,937	660	1,984	0	0
801,380,000	359,290,000	442,090,000	192,341	175,896	16,445	10,428	264,177	8,358	46,283	10,448	21,213	740	1,489,800
24,529,000	16,310,000	8,219,000	4,745	3,146	1,599	588	10,585	1,038	14,372	447	1,431	22	66,500
191,914,000	154,814,000	37,100,000	21,491	18,620	2,871	8,054	103,485	518	16,130	3,442	8,317	1,158	1,525,500
70,445,000	56,620,000	13,825,000	4,333	2,627	1,706	3,731	83,954	144	717	1,863	7,026	0	0
826,880,000	382,310,000	444,570,000	296,730	259,480	37,250	110,994	874,269	6,301	67,004	82,307	83,125	1,505	4,050,000
440,000	433,000	7,000	8	8	0	106	129	15	72	115	128	0	0
89,194,000	76,206,000	12,988,000	7,864	7,037	827	3,202	33,517	1,319	15,550	1,275	4,844	6,005	1,256,500

country is still a potential field for central-station development puts a very rosy tinge on the future of the central-station power load.

The greatest degree of electrification was reported by the transportation equipment industry, with 87.2 per cent electrification, and the lowest electrification was reported by the lumber industry, with 31.2 per cent. The reasons for these figures are obvious. The transportation equipment industry, which includes automobile, aircraft and all forms of water and land craft, is an industry that has shown the same marvelous development which has been experienced by the electric light and power industry since 1913. It has grown with the electrical industry, is located almost entirely within

Table III—Distribution of the Industrial Power Load in Middle Atlantic States as

Industry	Primary Horsepower						Electric Motors Run by Energy Generated in Private Plants, Hp.	Boilers		Number of Companies Having Private Electric Generating Plants	Estimated Rating of Prime Movers Used in Private Generating Plants, Hp.
	Total Primary Horsepower	Owned by Establishments Reporting				Electric Motors Run by Purchased Energy, Hp.		Number	Hp.		
		Steam Engines (Not Turbines)	Steam Turbines	Internal-Combustion Engines	Water Turbines						
All industries	9,593,833	4,246,432	1,028,077	400,646	388,510	3,530,168	3,068,554	18,211	5,394,650	2,456	2,182,000
Chemicals and allied products	838,719	336,958	180,132	19,192	51,671	250,766	246,595	2,555	892,000	250	180,100
Food and kindred products	799,804	317,298	21,451	30,962	27,204	402,889	128,691	2,350	440,500	351	98,100
Iron and steel and their products, not including machinery	3,153,594	1,836,917	420,321	257,222	6,470	632,664	1,422,035	5,304	1,847,000	296	1,007,900
Leather and its finished products	128,935	60,771	13,516	3,027	1,793	49,828	52,264	594	117,600	88	21,080
Lumber and allied products	443,202	281,825	14,896	8,161	7,464	130,856	45,923	1,852	458,100	169	51,040
Machinery	700,191	162,420	110,169	25,969	8,213	393,420	279,422	672	184,900	310	88,890
Metals and metal products other than iron and steel	248,553	109,271	32,063	4,042	316	102,861	88,754	322	84,660	83	69,080
Miscellaneous industries	221,796	71,113	23,950	4,822	1,370	120,541	41,359	319	106,950	75	55,630
Musical instruments and phonographs	39,900	13,714	12,892	382	4	12,908	22,592	46	18,980	24	19,660
Paper and printing	820,300	244,893	32,257	3,751	246,368	293,031	160,851	621	237,800	195	180,400
Railroad repair shops	199,658	89,892	13,294	8,459	10	88,003	90,941	419	116,830	61	55,690
Rubber products	125,471	37,895	8,621	259	1,010	77,686	26,366	238	68,950	41	25,170
Stone, clay and glass products	596,373	247,335	30,851	23,018	4,420	290,749	134,465	1,025	363,200	155	70,620
Textiles and their products	831,754	355,940	80,104	7,184	23,637	364,889	217,330	1,664	393,200	290	181,000
Tobacco manufactures	10,659	3,681	302	33	0	6,643	891	45	7,380	19	1,320
Transportation equipment, air, land and water	434,924	76,509	33,258	4,163	8,560	312,434	110,075	185	50,600	49	76,320

Table IV—Distribution of the Industrial Power Load in the South Atlantic States

Industry	Primary Horsepower						Electric Motors Run by Energy Generated in Private Plants, Hp.	Boilers		Number of Companies Having Private Electric Generating Plants
	Total Primary Horsepower	Owned by Establishments Reporting				Electric Motors Run by Purchased Energy, Hp.		Number	Hp.	
		Steam Engines (Not Turbines)	Steam Turbines	Internal Combustion Engines	Water Turbines					
All industries	3,183,936	1,250,636	235,156	113,603	258,558	1,325,983	655,719	6,356	1,382,790	704
Chemicals and allied products	424,115	110,068	21,116	11,807	110,114	171,010	58,057	704	147,160	69
Food and kindred products	310,626	127,097	11,238	22,210	15,969	134,112	21,526	996	209,610	154
Iron and steel and their products, not including machinery	380,702	128,617	61,967	36,083	1,713	152,322	236,469	199	68,048	33
Leather and its finished products	32,459	17,310	3,607	94	290	11,158	7,024	315	51,015	22
Lumber and allied products	461,724	374,835	19,905	4,774	850	61,360	36,167	2,134	420,690	100
Machinery	54,946	6,957	808	4,553	315	42,313	7,252	78	21,872	11
Metals and metal products other than iron and steel	42,783	6,669	1,409	1,306	0	33,399	7,901	12	5,000	7
Musical instruments and phonographs	790	330	20	0	0	440	305	1	250	1
Paper and printing	130,812	50,634	22,010	991	14,235	42,942	44,310	91	41,834	42
Railroad repair shops	94,446	29,005	11,682	599	0	53,160	30,311	100	32,300	26
Rubber products	22,564	15,505	982	0	0	6,077	14,466	9	5,404	1
Stone, clay, and glass products	153,160	52,330	6,130	20,804	2,972	70,924	32,714	347	58,190	56
Textiles and their products	939,269	291,227	67,618	6,957	112,025	461,442	141,381	1,069	264,545	151
Tobacco manufacturers	17,876	10,690	2,722	150	0	4,314	8,939	153	24,867	9
Transportation equipment, air, land and water	82,906	12,802	1,959	2,772	0	65,373	6,742	45	19,020	6
Miscellaneous industries	34,758	16,560	1,983	503	75	15,637	2,155	103	12,985	16

Table V—Distribution of the Industrial Power Load in the North Central States

Industry	Primary Horsepower						Electric Motors Run by Energy Generated in Private Plants, Hp.	Boilers		Number of Companies Having Private Electric Generating Plants
	Total Primary Horsepower	Owned by Establishments Reporting				Electric Motors Run by Purchased Energy, Hp.		Number	Hp.	
		Steam Engines (Not Turbines)	Steam Turbines	Internal-Combustion Engines	Water Turbines					
All industries	10,819,210	4,150,814	1,207,217	535,780	312,022	4,613,377	3,336,472	18,755	5,418,796	2,816
Chemicals and allied products	724,930	304,030	133,159	17,149	2,113	268,479	229,181	1,833	621,262	189
Food and kindred products	1,562,360	670,854	70,030	66,662	57,400	697,414	260,758	3,603	936,702	667
Iron and steel and their products, not including machinery	2,898,036	1,334,245	460,198	316,898	2,800	783,895	1,254,257	3,536	1,492,229	252
Leather and its finished products	120,205	52,909	16,203	720	86	50,287	43,695	330	75,946	91
Lumber and allied products	680,123	422,097	24,570	8,022	2,466	221,968	127,330	2,372	509,423	336
Machinery	1,024,273	192,614	59,413	27,193	6,958	738,095	293,546	1,495	311,893	294
Metals and metal products other than iron and steel	237,374	73,387	14,221	2,908	1,973	144,885	52,220	318	89,084	65
Musical instruments and phonographs	32,994	15,224	3,362	353	30	14,025	13,501	299	38,773	24
Paper and printing	850,586	301,239	78,038	3,146	224,294	243,869	245,484	685	243,420	204
Railroad repair shops	303,893	120,966	22,066	11,802	3	149,056	110,645	1,043	237,808	122
Rubber products	289,499	48,963	104,445	68	3,986	132,037	116,870	141	91,935	27
Stone, clay, and glass products	762,081	324,791	70,080	32,717	1,280	333,213	208,422	1,242	287,601	268
Textiles and their products	161,542	64,526	12,272	1,488	5,791	77,465	37,255	392	83,098	122
Tobacco manufacturers	8,705	4,966	526	26	0	3,187	3,262	24	5,088	8
Transportation equipment, air, land and water	968,311	173,376	131,588	42,707	1,443	620,197	323,983	629	299,371	52
Miscellaneous industries	194,298	46,627	7,046	3,921	1,399	135,305	16,063	813	95,163	95

reach of central-station lines and therefore has adopted the most efficient power machine, the electric motor, to a very high degree. The lumber industry, on the other hand, is located for the most part in isolated regions, with plenty of cheap fuel readily at hand, and has been slow to adopt the electric motor into its mills. That all industries are very largely creatures of environment is indicated in the relative electrification of these two industries.

During 1924 the manufacturing plants of the country consumed a total of 31,004,483,000 kw.-hr. of electrical energy for power purposes. Although this amount is reported as being used for power purposes, it is very probable that it includes to a very large degree the

of January 1, 1924, and Energy Consumed by Industrial Plants During 1924

Estimated Electrification of Industry, Per Cent	Energy Consumed			Generated in Private Plants			A.C. Motors		D.C. Motors		Motors Under 5 Hp.	
	Total from Consumed, Kw.-Hr.	Purchased from Central Stations, Kw.-Hr.	Generated in Private Plants, Kw.-Hr.	Total Rating of Generators, Kva.	Rating of A.-C. Generators, Kva.	Rating of D.-C. Generators, Kw.	Number	Hp.	Number	Hp.	Number	Hp.
59.6	10,501,508,000	6,586,337,000	3,915,171,000	2,022,050	1,511,375	510,675	251,923	4,122,420	223,145	2,476,302	246,227	592,570
51.4	2,475,400,000	2,086,400,000	389,000,000	166,800	140,860	25,940	25,690	382,005	10,120	115,356	16,375	74,450
62.7	680,580,000	515,700,000	164,880,000	91,080	40,830	50,250	16,920	234,818	42,940	296,762	35,110	81,890
52.0	2,421,000,000	745,400,000	1,675,600,000	934,400	737,200	197,200	20,805	786,990	563,930	1,267,709	18,470	46,690
55.0	160,200,000	78,220,000	81,980,000	19,530	9,570	9,960	5,585	48,984	4,240	53,108	4,130	11,270
41.0	265,065,000	196,200,000	68,865,000	47,290	32,630	14,660	11,210	128,371	5,120	48,408	10,720	24,860
69.0	337,798,000	222,400,000	115,398,000	82,330	48,775	33,555	15,390	635,102	15,930	37,740	17,640	43,760
69.2	400,150,000	242,350,000	157,800,000	63,920	19,820	44,100	7,470	88,141	12,815	103,474	8,350	19,290
79.4	274,840,000	204,660,000	70,180,000	51,540	8,750	42,790	9,990	51,231	12,240	110,669	16,445	24,640
81.5	25,440,000	9,257,000	16,183,000	18,220	14,360	3,860	1,508	22,717	1,360	12,783	2,137	5,515
57.7	1,269,250,000	819,750,000	449,500,000	167,100	149,750	17,350	12,420	406,431	5,190	47,451	7,825	20,360
71.9	175,550,000	86,350,000	89,200,000	51,590	34,150	17,440	4,240	75,431	7,480	103,513	3,235	10,360
81.9	124,875,000	93,120,000	31,755,000	23,320	18,910	4,410	4,730	80,117	1,710	23,935	4,410	14,110
60.6	685,630,000	468,780,000	216,850,000	65,400	39,070	26,330	18,195	297,978	18,760	127,236	19,780	82,690
65.7	676,150,000	423,800,000	252,350,000	167,600	150,800	16,800	66,130	507,427	14,220	74,792	60,300	97,700
74.8	16,500,000	14,550,000	1,950,000	1,220	0	1,220	3,960	4,805	550	2,729	4,330	1,905
89.5	513,080,000	379,400,000	133,680,000	70,710	65,900	4,810	27,680	371,872	6,540	50,637	16,970	33,080

as of January 1, 1924, and Energy Consumed by Industrial Plants During 1924

Estimated Rating of Prime Movers Used in Private Generating Plants, Hp.	Estimated Electrification of Industry Per Cent	Energy Consumed			Generators in Private Plants			A.C. Motors		D.C. Motors		Motors Under 5 Hp.	
		Total Energy Consumed, Kw.-Hr.	Purchased from Central Stations, Kw.-Hr.	Generated in Private Plants, Kw.-Hr.	Total Rating of Generators, Kva.	Rating of A.C. Generators, Kva.	Rating of D.C. Generators, Kw.	Number	Hp.	Number	Hp.	Number	Hp.
483,514	56.8	2,139,653,000	1,399,178,000	740,475,000	447,916	382,430	65,486	119,540	1,544,834	34,630	436,868	73,983	167,459
45,409	51.1	351,603,000	262,471,000	89,132,000	42,060	31,510	10,550	9,710	199,115	1,327	29,952	8,792	15,378
9,992	46.4	252,073,000	217,205,000	34,868,000	9,265	3,755	5,510	3,652	58,476	8,906	97,162	6,540	16,663
129,990	74.2	515,575,000	202,002,000	313,573,000	120,390	107,980	12,410	6,648	251,651	4,958	137,140	2,694	8,320
8,170	59.5	31,519,000	19,342,000	12,177,000	7,570	3,710	3,860	921	17,219	97	963	315	1,108
56,165	25.5	74,130,000	46,649,000	27,481,000	52,000	49,340	2,660	6,166	94,201	224	3,326	2,499	6,843
3,521	83.5	30,487,000	26,025,000	4,462,000	3,260	1,380	1,880	242	11,388	2,190	38,177	668	1,986
6,640	93.5	70,205,000	56,780,000	13,425,000	6,160	5,840	320	858	29,249	485	12,051	395	821
280	91.2	533,000	305,000	228,000	260	210	50	33	478	29	267	45	134
49,924	71.0	97,308,000	47,628,000	49,680,000	46,273	40,203	6,070	1,798	77,483	2,561	9,769	2,699	7,104
20,675	78.3	104,879,000	66,804,000	38,075,000	19,130	14,815	4,315	2,948	77,498	585	5,973	2,553	7,947
7,790	61.5	13,955,000	4,135,000	9,820,000	7,220	7,030	190	649	17,159	208	3,384	506	1,144
23,070	61.3	149,788,000	102,472,000	47,316,000	21,370	18,760	2,610	2,652	96,175	749	7,463	1,300	3,467
106,870	60.6	371,781,000	284,632,000	87,149,000	99,040	97,300	1,740	78,474	588,224	941	14,599	37,589	75,896
5,759	56.3	9,488,000	3,088,000	6,400,000	5,338	12	5,326	2,790	4,241	2,310	9,012	2,816	6,554
7,095	87.4	48,537,000	44,003,000	4,534,000	6,580	585	5,995	1,444	19,438	6,069	52,677	1,362	2,734
2,164	51.2	17,792,000	15,637,000	2,155,000	2,000	0	2,000	555	2,839	2,991	14,953	3,210	11,360

as of January 1, 1924, and Energy Consumed by Industrial Plants During 1924

Estimated Rating of Prime Movers Used in Private Generating Plants, Hp.	Estimated Electrification of Industry Per Cent	Energy Consumed			Generators in Private Plants			A.C. Motors		D.C. Motors		Motors Under 5 Hp	
		Total Energy Consumed, Kw.-Hr.	Purchased from Central Stations, Kw.-Hr.	Generated in Private Plants, Kw.-Hr.	Total Rating of Generators, Kva.	Rating of A. C. Generators, Kva.	Rating of D. C. Generators, Kw.	Number	Hp.	Number	Hp.	Number	Hp.
2,311,227	64.0	10,653,041,000	6,151,506,000	4,501,535,000	2,141,601	1,498,988	642,613	407,138	5,134,609	262,478	2,815,240	343,339	796,654
291,980	77.6	575,419,000	310,883,000	264,536,000	270,550	139,135	131,415	19,625	293,064	49,778	204,596	45,012	83,724
274,624	62.0	1,963,912,000	1,429,620,000	534,292,000	254,429	177,234	77,195	47,914	643,872	29,050	314,300	38,356	102,245
753,738	53.0	2,537,484,000	973,976,000	1,563,508,000	698,267	588,199	110,068	22,573	816,507	45,750	1,221,645	21,870	71,440
24,461	62.2	96,015,000	51,943,000	44,072,000	22,677	11,786	13,891	9,112	65,664	6,041	28,318	9,574	26,551
39,194	38.4	244,669,000	156,132,000	88,537,000	36,296	28,940	7,356	35,587	313,862	5,399	35,436	25,803	68,542
162,488	88.5	971,528,000	693,383,000	278,145,000	150,540	88,490	62,050	72,442	607,122	46,428	424,519	76,394	147,551
44,378	79.8	218,339,000	161,131,000	57,208,000	41,098	21,805	19,293	6,439	110,917	8,813	86,188	7,342	18,361
7,160	64.2	22,348,000	11,386,000	10,962,000	6,640	3,115	3,525	2,920	26,526	408	1,000	938	796
232,425	56.0	1,386,467,000	687,235,000	699,232,000	215,425	177,085	38,340	13,225	397,662	9,795	91,691	7,858	21,463
54,905	67.1	180,206,000	103,446,000	76,760,000	51,020	32,985	18,035	9,890	148,366	7,417	111,335	6,142	21,968
97,080	79.2	500,522,000	265,382,000	235,140,000	90,060	79,705	10,355	54,240	219,803	3,195	29,104	40,907	94,485
60,293	51.6	333,500,000	203,642,000	129,858,000	55,843	42,803	13,040	5,558	503,833	3,784	37,802	2,553	7,363
39,581	72.6	180,343,000	121,625,000	58,718,000	36,681	29,157	7,524	11,636	88,093	4,950	26,627	12,259	23,490
4,540	88.7	10,861,000	5,367,000	5,494,000	4,215	4,215	0	1,463	6,449	0	0	988	1,576
211,200	85.9	1,311,208,000	867,635,000	443,573,000	195,670	68,864	126,806	89,531	835,939	10,700	108,241	18,036	53,032
13,180	76.4	120,220,000	108,720,000	11,500,000	12,190	5,470	6,720	4,983	56,930	30,970	94,438	29,307	54,067

Table VI—Distribution of the Industrial Power Load in the South Central States

Industry	Primary Horsepower						Electric Motors Run by Energy Generated in Private Plants, Hp.	Boilers		Number of Companies Having Private Electric Generating Plants
	Total Primary Horsepower	Owned by Establishments Reporting				Electric Motors Run by Purchased Energy, Hp.		Number	Hp.	
		Steam Engines (Not Turbines)	Steam Turbines	Internal-Combustion Engines	Water Turbines					
All industries	2,730,951	1,528,697	195,998	106,080	23,712	876,464	347,203	7,968	1,654,926	754
Chemicals and allied products	442,189	227,460	42,290	20,533	235	151,671	96,481	1,811	378,650	99
Food and kindred products	507,537	293,510	9,674	50,901	7,179	146,273	38,389	1,908	495,770	269
Iron and steel and their products, not including machinery	418,308	203,523	75,188	321	0	139,276	58,930	203	104,895	26
Leather and its finished products	10,253	3,652	428	114	150	5,909	649	33	4,900	6
Lumber and allied products	679,112	578,428	33,326	8,506	161	58,691	64,084	3,048	423,720	185
Machinery	55,247	9,791	711	5,724	10	39,011	5,825	76	13,725	28
Metals and metal products other than iron and steel	52,229	8,820	2,930	1,094	0	39,385	4,198	51	18,125	5
Musical instruments and phonographs	478	79	296	0	0	103	269	1	268	1
Paper and printing	58,837	16,932	7,257	1,668	68	32,912	12,750	50	15,735	12
Railroad repair shops	90,464	35,860	3,259	2,030	0	49,315	21,526	265	64,115	36
Rubber products	1,167	200	5	10	0	952	0	3	82	0
Stone, clay, and glass products	152,855	64,976	8,071	10,637	4,794	64,377	28,038	176	51,380	42
Textiles and their products	184,279	55,457	7,850	2,057	11,040	107,875	8,740	194	52,987	25
Tobacco manufacturers	5,289	3,220	1,024	1	0	1,044	2,159	31	4,580	7
Transportation equipment, air, land and water	47,795	20,143	1,003	1,334	0	25,315	5,057	77	19,461	10
Miscellaneous industries	24,912	6,646	2,686	1,150	75	14,355	108	41	6,533	3

energy used in lighting the plants. It must be remembered that this survey does not cover the use of electric power in mines and quarries, on farms, in commercial non-manufacturing establishments or by the electric railroads of the country. It is estimated that a total of 71,200,000,000 kw.-hr. of electrical energy was generated in the United States during 1924, of which 12,600,000,000 kw.-hr. was used for domestic, commercial and street-lighting purposes, 36,700,000,000 kw.-hr. was used for power purposes, including manufacturing, mining, irrigation, etc., a total of 10,400,000,000 kw.-hr. was consumed by electric railways, and 11,500,000,000 kw.-hr. were lost in transmission. These figures indicate an increase of approximately twenty-one billion kilowatt-hours in the annual electrical output since 1920, when the total output was estimated at 49,802,000,000 kw.-hr.

There are 8,157 private industrial electric-generating plants in the country with a total generator rating of 5,913,462 kva., or approximately one-fifth of the present aggregate generator rating of the central stations of the country. Of the total generator rating, 1,501,885 kw., or 25.4 per cent, is in direct-current machines, quite a different picture from that presented by the central-station industry, where only 1.4 per cent of the total generator rating is in direct-current machines. Some indication, however, of the large amount of central-station energy that is converted from alternating to direct current for use in the manufacturing plants of the nation is to be gathered from the fact that almost one-third of the motor horsepower is in direct-current machines.

IRON AND STEEL INDUSTRY 54 PER CENT ELECTRIFIED

The greatest user of electrical energy in so far as the total consumption is concerned is the iron and steel industry, this industry being 54 per cent electrified. This industry consumed 6,103,792,000 kw.-hr. in 1924, of which 3,710,003,000 kw.-hr., or 60.8 per cent, was generated in private plants. An effort was made to ascertain what proportion of this energy was consumed for industrial heating purposes, but the returns were not sufficient to warrant an estimate on this item. The United States Census Bureau, however, has added questions on industrial electric heating to the census which it is taking at the present time. It is probable, therefore, that reliable data on industrial heating will be available by the end of the present year.

There are 679 private electric-generating plants in the iron and steel mills of the country; these, in 1924, generated 3,710,003,000 kw.-hr. of electrical energy. These private plants had an installed generator rating of 1,830,094 kva., or sufficient rating to furnish the present energy requirements for light, heat, power and

Table VII—Distribution of the Industrial Power Load in the Mountain and Pacific States

Industry	Primary Horsepower						Electric Motors Run by Energy Generated in Private Plants, Hp.	Boilers		Number of Companies Having Private Electric Generating Plants
	Total Primary Horsepower	Owned by Establishments Reporting				Electric Motors Run by Purchased Energy, Hp.		Number	Hp.	
		Steam Engines (Not Turbines)	Steam Turbines	Internal-Combustion Engines	Water Turbines					
All industries	2,664,687	925,761	180,599	51,098	59,304	1,447,925	378,198	2,784	734,331	389
Chemicals and allied products	195,887	45,566	11,947	7,137	991	130,246	14,968	199	57,232	20
Food and kindred products	419,802	137,703	8,349	9,323	6,916	257,511	44,921	419	92,356	118
Iron and steel and their products, not including machinery	128,201	44,579	3,164	253	0	80,205	10,728	62	20,843	2
Leather and its finished products	8,290	2,159	422	6	0	5,703	842	24	2,919	4
Lumber and allied products	874,664	563,298	91,717	14,709	10,915	194,025	211,388	1,635	440,836	160
Machinery	92,132	1,330	1,550	1,072	41	88,139	330	43	4,328	4
Metals and metal products other than iron or steel	379,596	63,937	53,915	13,094	4,575	244,075	60,345	109	55,405	14
Musical instruments and phonographs	834	0	0	0	0	834	0	0	0	0
Paper and printing	161,416	28,151	6,083	323	30,668	96,191	18,346	97	28,760	19
Railroad repair shops	91,066	21,542	1,308	707	75	67,434	9,978	27	9,608	22
Rubber products	20,274	115	195	0	0	19,964	0	1	166	0
Stone, clay, and glass products	142,157	12,995	661	2,975	3,389	122,137	4,726	131	16,118	14
Textiles and their products	23,685	1,195	808	43	1,636	20,003	393	14	2,565	5
Tobacco manufacturers	517	0	0	0	0	517	0	0	0	0
Transportation equipment, air, land and water	78,648	1,034	74	209	5	77,326	479	5	834	3
Miscellaneous industries	47,518	2,157	406	1,247	93	43,615	754	18	2,361	4

...s of January 1, 1924, and Energy Consumed by Industrial Plants During 1924

...stimated Rating of Prime Movers Used in Private Generat-...g Plants, Hp.	Esti-mated Electri-fication of Industry Per Cent	Energy Consumed			Generators in Private Plants			A.C. Motors		D.C. Motors		Motors Under 5 Hp.	
		Total Energy Consumed, Kw.-Hr.	Purchased from Central Stations, Kw.-Hr.	Generated in Private Plants, Kw.-Hr.	Total Rating of Generators, Kva.	Rating of A.C. Generators, Kva.	Rating of D.C. Generators, Kw.	Number	Hp.	Number	Hp.	Number	Hp.
310,413	43.2	2,038,232,000	1,386,567,000	651,665,000	287,388	173,210	114,178	43,718	888,684	52,935	334,983	57,484	116,812
81,235	52.7	648,460,000	396,640,000	251,820,000	75,270	60,220	15,050	9,110	213,188	1,881	34,964	2,914	8,398
93,785	47.3	221,420,000	175,395,000	46,025,000	86,790	32,520	54,270	4,752	95,084	14,929	89,578	8,347	23,943
20,195	39.0	285,551,000	200,613,000	84,938,000	18,700	17,164	1,536	1,947	142,682	1,826	55,524	345	439
759	65.0	11,375,000	10,250,000	1,125,000	702	341	361	273	2,788	151	3,770	92	279
36,100	14.0	219,816,000	105,095,000	114,721,000	33,432	15,960	17,472	5,991	110,254	649	12,521	1,899	6,686
5,712	81.0	42,274,000	36,780,000	5,494,000	5,287	3,297	1,990	2,829	37,882	858	6,954	2,894	6,308
9,060	92.8	58,644,000	52,026,000	6,618,000	8,390	2,080	6,310	1,161	30,225	758	13,358	462	1,658
236	71.0	267,000	74,000	193,000	218	172	46	16	238	14	134	22	66
11,440	75.4	117,284,000	84,470,000	32,814,000	10,577	7,985	2,592	627	32,499	316	13,163	607	977
11,096	66.8	35,759,000	24,925,000	10,834,000	10,279	7,017	3,262	3,351	51,345	1,175	19,496	1,321	4,125
0	81.6	646,000	646,000	0	0	0	0	32	796	11	156	24	56
26,779	53.6	285,648,000	198,993,000	86,655,000	24,779	19,500	5,279	1,892	82,930	848	9,485	483	927
6,642	62.1	71,915,000	66,520,000	5,395,000	6,143	5,353	790	11,114	84,511	25,058	32,104	33,775	48,642
1,430	46.8	1,592,000	519,000	1,073,000	1,320	940	380	170	1,950	134	1,253	39	91
5,834	65.2	23,118,000	19,266,000	3,852,000	5,400	661	4,739	0	0	1,898	30,372	1,737	5,211
110	58.0	14,463,000	14,355,000	108,000	101	0	101	453	2,312	2,429	12,151	2,523	9,006

transportation of both the cities of New York and Chicago combined. Of the total generator rating 332,316 kw., or 18.1 per cent, is in direct-current machines. There are 184,450 electric motors installed in the iron and steel mills of the country, of which 122,056, or 66.0 per cent, are direct-current. The large influence of the private plant in the iron and steel industry is again brought out by the fact that motors totaling 3,029,828 hp. are run by energy generated in private plants, whereas the rating of motors run by energy purchased from central stations is only 1,931,549 hp.

The second largest user of electrical energy for power purposes is the chemicals and allied products industry, which consumed 4,442,612,000 kw.-hr. during 1924, of which more than three-quarters is supplied by central-station companies. The outstanding fact regarding the use of electrical energy in this group of industries is that approximately one-half the motors are direct-current, although their aggregate rating is only one-third that of the alternating-current motors.

Mountain-Pacific States Report 65 per Cent Electrification of Industry

A glance at the tabulations giving the use of electrical power in the various sections of the country brings out the large potential field that is available for the future development of the central-station industrial power load. The Mountain and Pacific States taken as a unit reported the highest electrification of industry, with 65 per cent electrification. Private plants generate only 20.8 per cent of the industrial electric power used in this section, remembering in this connection that this survey did not include mining or agriculture. The central-station industry in this section, therefore, has developed only approximately 51.4 per cent of its potential industrial field. The largest industry of this section in so far as power is concerned, the lumber industry, offers large resistance to electrification from central-station lines. At the present time this industry is only 36.2 per cent electrified and more than half the electrical power used in these lumber mills is generated in private generating plants. Every other industry in this section, however, is more than two-thirds electrified, and several are very close to saturated electrically.

The New England, Middle Atlantic and North Central States are all well over 50 per cent electrified. Detail studies of these three sections were published in the ELECTRICAL WORLD issues of September 12, 1925, October 10, 1925, and November 14, 1925, respectively. The Southern States reported the lowest electrification of industry of any section with 50.6 per cent. A detail study of this section was published in the December 19, 1925, issue of ELECTRICAL WORLD. Detail data for the various states is also available upon application.

...s of January 1, 1924, and Energy Consumed by Industrial Plants During 1924

Estimated Rating of Prime Movers Used in Private Generat-...g Plants, Hp.	Esti-mated Electri-fication of Industry Per Cent	Energy Consumed			Generators in Private Plants			A.C. Motors		D.C. Motors		Motors Under 5 Hp.	
		Total Energy Consumed, Kw.-Hr.	Purchased from Central Stations, Kw.-Hr.	Generated in Private Plants, Kw.-Hr.	Total Rating of Generators, Kva.	Rating of A.C. Generators, Kva.	Rating of D.C. Generators, Kw.	Number	Hp.	Number	Hp.	Number	Hp.
283,804	65.0	2,578,852,000	2,042,912,000	535,940,000	262,942	216,868	46,074	87,780	1,424,942	38,218	401,181	61,497	189,144
15,428	74.2	293,059,000	262,828,000	30,231,000	14,293	14,277	16	8,572	96,960	9,751	48,254	8,883	42,100
42,800	71.5	276,997,000	235,872,000	41,125,000	39,658	32,895	6,763	16,647	248,026	5,828	54,406	15,859	42,219
7,400	68.4	101,321,000	39,351,000	11,970,000	6,850	4,025	2,825	1,146	40,395	2,224	50,538	650	2,188
966	80.4	8,171,000	7,119,000	1,052,000	896	0	896	128	1,660	795	4,885	344	1,031
122,939	36.2	517,881,000	247,833,000	270,048,000	113,950	106,838	7,112	14,723	391,631	561	13,782	4,922	17,389
232	95.8	74,870,000	74,590,000	280,000	215	0	215	3,745	27,491	8,741	60,976	5,873	12,455
66,935	82.1	577,568,000	462,858,000	114,710,000	62,009	38,064	23,945	6,589	236,488	2,160	67,932	4,630	11,013
0	100.0	677,000	677,000	0	0	0	0	48	774	14	60	22	33
14,613	68.6	314,450,000	263,950,000	50,500,000	13,546	11,522	2,024	2,772	67,258	3,423	47,279	2,139	5,268
8,416	83.3	71,467,000	62,244,000	9,223,000	7,752	7,412	340	1,887	39,954	2,356	37,458	1,735	4,454
0	98.6	40,162,000	40,162,000	0	0	0	0	1,042	19,102	143	862	545	1,798
1,964	87.3	113,132,000	108,914,000	4,218,000	1,817	22	1,795	12,748	118,268	1,404	8,595	6,899	22,409
419	86.3	44,033,000	43,184,000	849,000	390	312	78	4,357	20,173	37	223	2,895	10,394
0	100.0	872,000	872,000	0	0	0	0	71	397	25	120	55	130
167	98.4	65,809,000	65,404,000	405,000	155	90	65	8,520	73,506	158	4,299	4,426	12,665
1,525	95.0	78,383,000	77,054,000	1,329,000	1,411	1,411	0	4,785	42,859	597	1,510	1,620	3,598

Electrical Exports Steady

Shipments of Direct-Current Generators and Transformers Decline—Appliances and Wiring Devices in Stronger Demand

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AMERICAN electrical exports during 1925 will be approximately equal to those of 1924, to judge from preliminary returns available for the first ten months. The total export trade for the year will be approximately $84,000,000. This does not take into account products of our electrical manufacturers that are exported in connection with other manufactured goods, such as the built-in motors of machine tools, washing machines and such equipment, or electrical equipment of complete automobiles. The total of such invisible exports is no small item.

Exports of apparatus show a decline as compared with the previous year, decreases in certain items not being fully compensated for by increases in others. Shipments of alternating-current generators increased slightly, the figures for the two alternating-current generator classes for the first ten months of the year totaling $1,472,918, as against $1,239,756 for the same period of 1924. For the same period of this year exports of steam-turbine generating sets were $486,161, which compares with $73,951 for the equivalent period of 1924. There was likewise a gain in the shipments of self-contained lighting sets, the total for the first ten months being $846,583, as against $687,951 for 1924. Gains in those classes, however, were not sufficient to offset decreases in other items.

Our foreign business in electric motors shows a slight decline from that of the previous year, though motors in the fractional horsepower class made a substantial gain during the first ten months of this year, the figure being $1,729,872, which compares with $1,451,486 for the same period of 1924. Offsetting this there were decreases in exports of both stationary motors and railway motors, the total of which was more than enough to cancel the gain in the fractional horsepower field.

There was little steam railway electrification work of any importance carried on during the year, and as a result exports of electric locomotives for railway service during the first ten months of 1925 were only $189,566, as against $1,912,418 during the same period of 1924. Exports of mining and industrial locomotives were practically the same as last year, the balance being slightly in favor of 1925. The number of units was considerably larger in 1924 than in the equivalent period of 1925, indicating a greater percentage of the heavier types this year.

That the growing interest in export trade apparent among manufacturers of various kinds of electrical appliances is productive of results is evidenced by the export figures for those classes. Shipments of motor-driven household devices during the ten-month period of 1925 reached $1,007,038, showing a handsome gain over the same period of 1924, when the total was only $741,298; exports of domestic heating and cooking devices also passed the million mark during the first ten months of this year, the preliminary total being $1,091,788, as against $904,979 for the same period of 1924. Shipments of electric fans show a small decline from 1924, and apparently the decrease has come in the smaller and cheaper types. Our export trade in commercial communications equipment was maintained at approximately the same level as during 1924. As might be expected the greatest individual gain is shown in the radio class. This widespread interest in radio also continued to influence exports of batteries.

Stressing the quality of American wiring devices, our manufacturers have been able to increase their business in this field steadily. During the first ten months of 1925 shipments of metal conduit, outlet and switch boxes were $648,897, as against $499,211 for the same period of 1924. Exports of sockets, receptacles and lighting switches were $1,288,178, as contrasted with $1,087,398 for the same period of 1924, and exports of electric lighting fixtures, street and interior, were $1,012,157, as compared with $602,627. In miscellaneous wiring devices there was a fair decline, but this was more than compensated for by the gains in the specific classes mentioned above.

In the line material field exports of electrical porcelain were approximately the same this year as last, and shipments of bare copper wire show a gain of approximately $300,000 over last year for the ten-month period under consideration. Aluminum wire exports, which are placed in a general class, were slightly larger this year than last, though the difference is not great. Exports of miscellaneous electrical items show this year an appreciable decrease as compared with last year, but this decrease is apparently owing to the growing use of the "Electrical Glossary" in preparing exporters' declarations and a better allocation of export items.

American electrical products were shipped to all parts of the world more or less regularly throughout the year, but the countries of North America and Central America made up the largest group total. Asia was next in rank, followed by Europe, South America, Australasia and Africa in order. Canada was, of course, the principal of our North American markets, taking approximately $9,224,227 worth of goods during the first nine months of the year. Cuba, with $3,474,106, was next high, and Mexico was third with $3,308,341. It is interesting to note that Panama ranks fourth, with $687,968, and Newfoundland and Labrador follow with a considerably lower amount, $175,581. Sixth and seventh in rank of our North and Central American markets are Guatemala and Salvador, with $167,350 and $163,040 respectively. Our exports to Europe show a small decline. The United Kingdom continued as our largest market, taking approximately 40 per cent of all the goods shipped into the European field.

Exports to South America showed a slight gain during the first nine-month period of this year as compared with last, and this is a gratifying result in view of the fact that there have been no large individual projects that have brought this figure up, so that the total represents a general strength in that field. As usual, Argentina is our leading market, with a total of $3,041,252, but Brazil is not far behind, our exports of electrical goods to that republic during the first nine months of this year being $3,035,095. Next in rank, as in previous years, is Chile, with Colombia fourth, followed by Peru, Venezuela and Uruguay in order.

Our Oceania markets, comprising Australia, New Zealand and the South Sea Islands, with a population of less than 10,000,000, took $4,672,833 worth of electrical products during the first nine months of the year, or more than half the amount taken by all South America, with a population of approximately 63,000,000.

Trends in Distribution

All Systems Seek to Improve Service Reliability—Increased Load Densities Have Introduced Alternating-Current Networks—Multiple-Feed Systems Popular —Light and Power Supply from Common Mains

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IN REVIEWING central-station distribution of electricity the systems can be conveniently divided into those supplying direct current and those supplying alternating current for utilization. A pronounced condition at present in the cities where direct current is used is to make definite and separate fields for the two systems. In many parts of the country this is accomplished by having definite geographic districts to which each system is limited. In other cities the service required determines the type of current to be supplied.

Broadly speaking, the direct-current system is at present applied to the densely loaded business and commercial zones of the larger cities, and in these districts it has been almost exclusively used up to this time. Previous developments in direct-current distribution have made this system simple and reliable. The past year has been noted mainly for the greater utilization of protective equipment which operating experience has shown to add still further to reliability of the system.

Alternating-current distribution, which has always been in general use for isolated and widely scattered loads, has now reached the condition where in numerous districts the load has become very dense. In addition, many times large individual blocks of alternating-current load are now superimposed on these dense distribution requirements. Such conditions have accentuated the requirement for system reliability and developments have been going on at an accelerated rate.

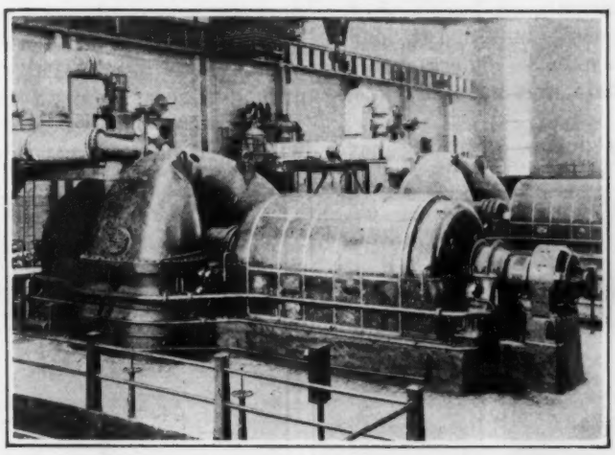
At first switches to throw over important loads onto a second supply and automatic reclosing of primary distribution circuits from substations were the two methods most commonly attempted to improve reliability. Automatic and remotely controlled substations which could be economically installed in relatively small units were the next step, and at the same time the low-voltage mains from a number of distribution transformers were interconnected—i.e., made into a network—to obtain the economies of larger-sized distribution transformers both as to cost and diversity. Where it was possible to do so advantage was gained by combining all the supply from one polyphase system of low-voltage mains and distribution transformers.

Recently these networks have been arranged so that they have several primary feeds in multiple with a portion of the distribution transformers, having their high-voltage windings connected to but one of the feeds, while the low-voltage windings of all the transformers are connected to the secondary network. The primary feeds are connected radially in certain instances, while in other systems the loop system is in use. With the multiple-feed network the reliability of supply is greatly increased over any previous arrangement of alternating-current distribution, owing to the ability to eliminate faults on high-voltage equipment by disconnecting at the low-voltage side of the distribution transformer supplied from the particular equipment in trouble—the remaining high-voltage feeds still continuing to serve the network. A fault occurring on any of the low-voltage equipment will eliminate itself if the system is designed to melt the conductors in case of a solid short circuit, for then an arcing fault results which eliminates itself at the voltages now used for secondary distribution. This arrangement allows failures of the low-voltage protective equipment to occur without jeopardizing the reliability of service.

With multiple feeding of networks the high-voltage supply is not limited to such low-voltage values as are required for highly reliable separate circuits. Moreover, different values of voltage may be used on the several feeds by having the distribution transformers of proper ratio connected to these feeds. Owing to this large savings are possible on those systems which are increasing rapidly, because new capacity can be supplied at generated voltage without the usual substation facilities being required, except voltage regulators, which, if used, may be located at the source or at the center of distribution, depending upon conditions of supply.

During the past year a number of the distribution systems in the large cities have either installed multiple-feed networks or are actively planning such a

Power Plants Gain in Economy



During the past year several new power stations went into operation which established new records for thermal efficiency. The engineers proved the economic merit of the new highly efficient plants and the trend toward reduction in costs continues unabated. View of two 40,000-kw. turbo-generators built by the General Electric Company and in operation at the Philo plant of the Ohio Power Company. They are designed for 600-lb. gage and 725-deg. total temperature.

development for next spring or summer. The various associations of central-station companies, the A. I. E. E. and the electrical technical press have given to the subject a large amount of publicity. All indications point to a widespread and rapid adoption of such systems in cities throughout the country.

COMMON SUPPLY FOR POWER AND LIGHT

The most important problem concerning the subject at the present time is whether both light and power are to be supplied from one set of mains and transformers. The typical system throughout the country uses three-phase, 220-volt motors and lighting at either 110, 115 or 120 volts. None of these voltages will give balanced load on a combined light and power system without the use of balanced coils, which eliminate the economies normally obtained from such a combination. Various compromises have been suggested, but the three in use to date are: (1) Three-phase, four-wire with 120 volts to neutral and 208 volts between phase wires; (2) three-phase, four-wire with 115 volts to neutral and 199 volts between phase wires, and (3) two-phase, five-wire with 110 volts to neutral and 220 volts between phase wires.

The problem of simplifying the protective equipment is one which holds out large hopes for the future as the quantity manufactured increases. Operating results with the equipment and systems in use fortify the belief of many engineers who have been connected with such systems that the reliability obtained will be of the same order as the reliability of the sources supplying the multiple feeds. Hence it is believed that the future problem in the study of alternating-current distribution reliability will concern itself more particularly with a study of the individual and related reliability of the sources rather than with the distribution equipment.

Lightning and Surges

Klydonograph Records Show Line Voltages May Reach 1,000,000—Direct Lightning Strokes Are Negative, Induced Strokes Positive

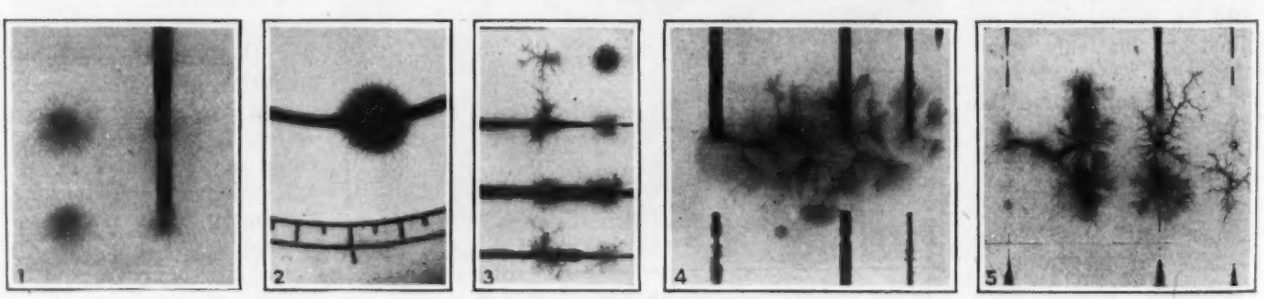
AT A meeting of the electrical apparatus committee of the N.E.L.A. in Philadelphia on Dec. 4, J. H. Cox gave a brief talk on field records obtained by using the klydonograph on several systems. These records are indicative only, but show data that have an important bearing on transmission.

Surges over a million volts due to lightning have been recorded. Where an oscillatory record was obtained on a grounded neutral open wire system, there were never more than two or three periods of the transient and the initial surge was much larger than the succeeding reflections, giving the effect of a unidirectional surge. On isolated neutral systems the duration of an oscillation was never over one-quarter second. The maximum frequency recorded was 17,000 cycles. Oscillatory records on a cable system were similar to those on grounded neutral open wire lines. The large majority of all surges are unidirectional.

The accompanying illustrations show some typical klydonograph records. The size in reproduction has not been preserved. In Fig. 1 the largest figure on the plate shows a unidirectional surge 6 times normal. Fig. 2 shows the worst oscillatory record obtained, 4.2 times normal, due to an arcing ground on an isolated neutral system. The other characteristics of the oscillation are as described in the previous paragraph. Fig. 3 shows two induced lightning surges, 7.8 times normal maximum. The figures are oscillatory, but in all of them one figure is much larger than those superimposed. Fig. 4 shows large negative figures, records of a direct stroke of lightning above the range of the instrument, but between 10 and 15 times normal, in this case between 1,000 and 1,500 kv. to ground. Fig. 5 shows a series of positive surges induced by lightning during one storm.

DATA ARE NOT CONCLUSIVE AS TIME HAS BEEN LIMITED

The klydonograph has been installed on several high-voltage lines in different parts of the country and some very valuable data have been collected. Sufficient time has not elapsed for positive conclusions to be made with respect to certain phenomena on lines which have been debated for several years, but the indications are rather clear that induced surges from lightning discharges are usually unidirectional and reach magnitudes several times the normal line voltage. Another interesting observation lies in the fact that switching surges were not found to be a frequent source of high potential disturbances or of surges; on the contrary, very few disturbances due to switching operations were recorded. Other interesting data are that direct strokes of lightning make negative records, while induced surges from lightning make positive records on the plates. No conclusive data are available on lines equipped with a ground wire as against those having no ground wire. It is expected that another year will give records which will afford data of great value to transmission engineers.



SURGES ON OPERATING SYSTEMS

Fig. 1—The largest figure is a unidirectional surge 6 times normal line voltage.

Fig. 2—An arcing ground oscillation 4.2 times normal voltage on an isolated neutral system.

Fig. 3—Two induced lightning surges 7.8 times normal maximum voltage.

Fig. 4—A direct stroke of lightning gives voltages 10 to 15 times normal. The direct strokes always give a negative figure on the plates.

Fig. 5—A group of positive voltages induced by lightning during a storm. These surges are always positive and very frequently are several times normal line voltage.

A Year of Intensive Construction

Mammoth Steam and Hydro-Electric Generating Plants Under Way in the United States and Western Canada During 1925—A Total of 7,381 Miles of High-Tension Transmission Line Erected During the Year Just Past

ONE of the outstanding developments in the electric light and power industry during 1925 was the tremendous amount of new construction completed and initiated during the year. The construction activities which made the year 1924 a record one for generation, transmission and distribution expansion were continued into 1925 with only a slight retardation.

By the economic laws which seem to govern the expansion of the industry's generating equipment the amount of this equipment added to the lines during 1925 should have been materially under that of 1924, the theory being that the record additions made during 1923 and 1924—6,450,000 kva. for the two years—would largely take care of the expected new load taken on the lines during 1925. And this proved to be the fact, the value of the steam and hydro generating equipment added during 1925 being approximately one hundred million dollars, or 25 per cent under that of 1924. Moreover, the generator rating added during the year was only 2,420,000 kva. On the other hand, the new transmission and distribution line construction, together with the substation and related construction during 1925, was approximately 12 per cent above that reported for 1924 and 10 per cent above that of 1923. In other words, 1925 was primarily a year of expansion in the transmission and distribution equipment of the industry. How this trend will be continued during 1926 is discussed elsewhere in this issue in connecton with the construction budgets for that year.

In the accompanying tables will be found data on the steam and hydro-electric plants now under construction or completed during the year, on the outstanding transmission and distribution extensions and on the activities of the Federal Power Commission to November 1, 1925. A list of plants under construction, though possibly not complete, is none the less indicative of the great expansion made during the year and that which will take place during 1926.

Table I—Steam-Electric Generating Plants East of the Rockies Completed in 1925, Now Under Construction or for Which Plans for an Early Start Are Made

Station	Company	Location	Initial Capacity Kw.	Date of Operation	Ultimate Capacity Kw.
Northeastern States					
East River	New York Edison Co.	14th St. and East River, N. Y. C.	120,000	Summer 1926	700,000
Richmond	Philadelphia Electric Co.	Philadelphia	100,000	Spring 1926	600,000
Harbor Point	Utica Gas & Electric Co.	Utica, N. Y.	60,000	Jan., 1926	150,000
Holtwood	Pennsylvania Water & Power Co.	Holtwood, Pa.	30,000	July, 1925	150,000
Edgar	Edison Elec. Illuminating Co. of Boston	Weymouth, Mass.	62,500	Jan., 1925	400,000
South Street	Narragansett Electric Lighting Co.	Providence, R. I.	43,500*†	Nov., 1925	.....
Kearny	Public Service Co. of N. J.	Kearny, N. J.	205,100†	1925	410,200†
Middletown	Metropolitan Edison Co.	Middletown, Pa.	30,000	1925	200,000
Lynn	Lynn Gas & Electric Co.	Lynn, Mass.	20,000*	1925	.....
Luzerne County	Luzerne Co. Gas & Electric Co.	Luzerne County, Pa.	20,000	1925	100,000
Somerset	Montaup Electric Co.	Somerset, Mass.	30,000	Sept., 1925	200,000
Southeastern States					
Cape Fear	Carolina Power & Light Co.	Moncure, N. C.	15,000*	1925	.....
Hale's Bar	Tennessee Electric Power Co.	Hale's Bar, Tenn.	22,500*	1925	.....
Miami	Miami Electric Light & Power Co.	Miami, Fla.	33,300†	1925	84,400†
Fourth Street	Memphis Power & Light Co.	Memphis, Tenn.	25,000*†	1925	.....
Waterside	Louisville Gas & Electric Co.	Louisville, Ky.	27,000*	Fall, 1925	.....
Gould Street	Consolidated Gas, Elec. Light & Pwr. Co.	Baltimore, Md.	36,000	1926	144,000
Parr Shoals	Broad River Power Co.	Parr Shoals, S. C.	15,000	Sept., 1925	7,500
Yadkin	Southern Power Co.	Yadkin River, N. C.	75,000	1926	75,000
Fort Lauderdale	Florida Power & Light Co.	New River, Fla.	50,000	1927	100,000
Sanford	Florida Power & Light Co.	St. Johns River, Fla.	10,000	1926	100,000
Middle Western States					
Avon	Cleveland Electric Illuminating Co.	Cleveland	67,500	Fall, 1926	300,000
Columbia Park	Columbia Gas & Electric Co.	Cincinnati	90,000	Dec., 1925	240,000
Riverside	United Light & Power Co.	Davenport, Ia.	25,000	1925	150,000
Philo	American Gas & Electric Co.	Zanesville, Ohio	80,000	Jan., 1925	240,000
Twin Branch	American Gas & Electric Co.	Mishawaka, Ind.	80,000	May, 1925	240,000
Joliet	Public Service Co. of Northern Ill.	Joliet, Ill.	30,000*	Jan., 1925	.....
Waukegan	Public Service Co. of Northern Ill.	Waukegan, Ill.	50,000*	.....	.....
Balls Ford	Des Moines Electric Light Co.	Des Moines, Ia.	50,000	Fall, 1925	145,000
Tecumseh	Kansas Power & Light Co.	Topeka, Kan.	15,000†	1925	75,000†
Crawford Avenue	Commonwealth Edison Co.	Chicago	160,000	May, 1925	750,000
Neosha	Kansas Gas & Electric Co.	Parsons, Kansas	15,000	1925	60,000
Toronto	Ohio River Edison Co.	Toronto, Ohio	66,000	1925	264,000
Detroit	Detroit Municipal	Detroit	60,000	1926	60,000
Riverside	Northern States Power Co.	Minneapolis	30,000*†	1925	.....
Big Sioux	Sioux City Gas & Elec. Co.	Sioux City, Iowa	25,000†	1925	75,000†
Lakeside	Milwaukee Elec. Ry. & Light Co.	Milwaukee	30,000*	1926	.....
Aurora	Western United Gas & Elec. Co.	Aurora, Ill.	23,500*	1926	40,000
Michigan City	Calumet Gas & Electric Co.	Michigan City, Ind.	60,000	Aug., 1927	.....
Green Bay	Wisconsin Public Service Corp.	Green Bay & Fox River	20,000	.....	.....
Fieway	Columbus Ry. Power & Light Co.	Scioto River, Ohio	60,000	1926	150,000
Southwestern States					
Market Street	New Orleans Public Service Co.	New Orleans, La.	25,000*†	1925	.....
Dallas	Dallas Power & Light Co.	Dallas, Texas	20,000*	1926	.....
Shreveport	Southwestern Gas & Electric Co.	Shreveport, La.	10,000	1925	50,000
Sterlington	Louisiana Power & Light Co.	Sterlington, La.	30,000	Nov., 1925	150,000
El Paso	El Paso Electric Railway Co.	El Paso, Tex.	15,000*	1925	.....
Guadalupe River	San Antonio Pulbic Service Co.	San Antonio, Tex.	22,500	Nov., 1926	75,000

*Extensions to existing plants. †Kva.—Capacities given in kva. are figured at 85 per cent power factor in calculating the total.

Table II—Hydro-Electric Generating Plants East of the Rockies Completed in 1925, Now Under Construction or for Which Plans for an Early Start Are Made

Station	Company	Location	Initial Capacity Kw.	Date of Operation	Ultimate Capacity Kw.
Northeastern States					
Soft Maple Dam	Northern New York Utilities	Beaver River near Watertown, N. Y.	20,000	Spring, 1926	30,000
Hawley	Pennsylvania Power & Light	Hawley, Pa.	40,000	1926	40,000
Sugar Island	St. Lawrence Valley Power Corp.	Raquette River, N. Y.	8,000	May, 1925	8,000
Parishville	St. Lawrence Valley Power Corp.	Branch of St. Regis River, N. Y.	4,000	Nov., 1925	4,000
Deerfield River	New England Power Co.	Deerfield River, Mass.	6,000†	Fall, 1926	6,000†
Cheat River	West Va. Power & Transmission Co.	Cheat River in Pennsylvania	96,000	.....	96,000
Oswego	F. L. Carlisle & Co.	Oswego, N. Y.	.....	1926	30,000
Southeastern States					
Terrora	Georgia Railway & Power Co.	Lake Tallulah, Ga.	11,250	March, 1925	22,500
Yonah	Georgia Railway & Power Co.	Tallulah River, Ga.	12,500	Fall, 1925	25,000
Nacoochee	Georgia Railway & Power Co.	Tallulah River, Ga.	5,000	1926–1927	5,000
Bartlett Ferry	Columbus Electric & Power Co.	Columbus, Ga.	30,000	1926–1927	60,000
Rhodhiss	Southern Power Co.	Rhodhiss, N. C.	33,750	1925	33,750
Rocky Creek	Southern Power Co.	Catawba, N. C.	60,000	1925	60,000
Fort Mill	Southern Power Co.	Catawba River, N. C.	94,000	1925	94,000
Rock Island	Tennessee Electric Power Co.	Rock Island, Tenn.	16,650*	1925	.....
Ocoee No. 3	Tennessee Electric Power Co.	Blue Ridge, Ga.	30,000†	1928	30,000†
Muscle Shoals	U. S. Government	Muscle Shoals, Tenn.	120,000‡	1925	612,000‡
Cherokee	Alabama Power Co.	Tallapoosa River, Ala.	90,000†	1926	180,000†
O'Neal	River Falls Power Co.	Patsilaga River, Ala.	10,000	.....	.....
Licking River	Kentucky Northern Power Co.	Falmouth, Ky.	27,000	1927	27,000
Dix Dam	Kentucky Hydro-Electric Co.	Dix Dam, Ky.	36,000†	1925	36,000†
Bristol	Cities Service Co.	Bristol-Va., Tenn.	1,275*	1926	.....
Middle Western States					
French Landing	Detroit Edison Co.	Huron River, Mich.	2,400	May, 1925	2,400
Blanchard Rapids	Minnesota Power & Light Co.	Royalton, Minn.	13,500	April, 1925	13,500
Hodenpyl	Consumers Power Co.	Manistee River, Mich.	18,000	Aug., 1925	18,000
Oakdale	Indiana Hydro-Electric Co.	Monticello, Indiana	10,500	June, 1925	10,500
Gasconade	Central Missouri Power & Water Co.	Gasconade River, Mo.	30,000	1926	30,000
Caldron Falls	Wisconsin Public Service Co.	Caldron Falls, Wisconsin	9,300†	1925	9,300†
Southwestern States					
Gonzales	Texas Central Power Co.	Gonzales, Texas	2,000*	1925	.....

*Extensions to existing plants. †Kva. Capacities given in kva. are figured at 85 per cent power factor in calculating the total. ‡Horsepower.

The year 1925 has been outstanding because of the completion and initiation of a number of very large electric generating plants, both steam and hydro. Some of these plants have attained nation-wide prominence, either because of their large size, their performance or on account of their unusual construction and electrical equipment. During the year steam plants with a total initial generator installation of 2,244,500 kw. and an ultimate capacity of 7,812,600 kw. were under construction or completed. The capacity of hydro-electric plants under construction or completed during the year totals 1,601,925 kw. initial installation and 2,883,100 kw. ultimate installation.

There were four steam-electric generating plants under construction or completed during the past year with an initial capacity of over 100,000 kw. each. By far the largest of these, as regards the initial installation, was the Kearny (N. J.) plant of the Public Service Electric & Gas Company of New Jersey. This plant, of which the first units have gone into regular operation, has an initial installed generator rating of 205,100 kva. and will have an ultimate capacity of 410,-

Table III—Hydro and Steam-Electric Development in Mountain and Pacific States and

Name of Company	Name of Plant	Location	Estimated Cost	Prime Movers
British Columbia Electric Railway Company	Bridge River	Seton Lake, B. C.	$8,100,000	Two 27,000 hp. impulses
British Columbia Electric Railway Company	Alouette	35 miles east of Vancouver, B. C.	1,875,000	One 12,500 hp. reaction
British Columbia Electric Railway Company	Stare Falls (fifth unit)	Stare Falls, B. C.	2,225,000	One 15,000 hp. Allis-Chalmers reaction
California Oregon Power Company	Copco No. 2	Klamath River, Cal.	6,000,000	Two 20,000 hp. Allis-Chalmers reaction
City of San Francisco	Moccasin	Tuolumne River, Cal.	15,000,000	Four 25,000 hp. Pelton impulse
City of Tacoma, Wash.	Cushman	Lake Cushman, Wash.	7,500,000	Two 25,000 hp. Allis-Chalmers reaction
Merced Irrigation District	Exchequer	Merced River, Cal.	6,000,000	Two 20,000 hp. Pelton reaction
Montana Power Company	Mystic Lake	Near Columbus, Mont.	2,225,000	Two 7,500 hp. Pelton impulse
Pacific Gas & Electric Company	Pit 3	Pit River, Cal.	14,900,000	Three 33,100 hp. Pelton reaction
Pacific Gas & Electric Company	Melones	Stanislaus River, Cal.	5,100,000	Two 17,000 hp. reaction
Puget Sound Power & Light Co.	Baker River	Baker River, Wash.	6,000,000	Two 20,000 hp. Allis-Chalmers reaction
Salt River Valley Water Users Assn.	Horse Mesa	Salt River, Ariz.	6,900,000	Three 15,280 hp. S. Morgan Smith reaction
Salt River Valley Water Users Assn.	Morman Flat	Morman Flat dam, Ariz.	1,500,000	One 10,000 hp. S. Morgan Smith reaction
San Joaquin Light & Power Corp.	Balch	Kings River, Cal.	6,000,000	Two 20,000 hp. Allis-Chalmers impulse
Southern California Edison Co.	Big Creek 2-A	Big Creek, Cal.	18,000,000	Two 60,000 hp. impulse
Southern California Edison Co.	Long Beach No. 2 additional unit steam plant	Long Beach, Cal.	5,600,000	One 52,800 kw. G.E. steam turbine
Turlock Irrigation District	La Grange	Tuolumne River, Cal.	650,000	One 4,000 hp. S. Morgan Smith reaction One 1,350 hp. S. Morgan Smith reaction
Utah Power & Light Co.	Cutler	Bear River, Utah	6,450,000	Two 21,500 hp. I. P. Morris reaction
Utah Power & Light Co.	Ashton additional units	Snake River, Idaho	1,370,000	Two 3,000 hp. S. Morgan Smith reaction One 3,150 hp. S. Morgan Smith reaction
Chelan Electric Co.	Chelan	Chelan River, Wash.	18,750,000	Possibly five 25,000 hp. reaction
Feather River Power Co.	Bucks Creek	Feather River, Cal.	9,600,000	Two 32,000 hp. impulse
Pacific Power & Light Co.	Clearwater	Clearwater River, Idaho.	2,225,000	One 15,000 hp. (approx.) reaction
Pacific Power & Light Co.	Youngs Bay add unit steam plant	Astoria, Ore.	670,000	One 6,250 kva. G.E. steam turbine
Los Angeles Bureau of Power & Light	Big Pine No. 3	Big Pine, Cal.	675,000	One 4,500 hp. Pelton impulse
Los Angeles Bureau of Power & Light	San Pedro steam plant	Los Angeles, Cal.	2,880,000	One 36,000 hp. (approx.) steam turbine
Los Angeles Gas & Electric Corp.	Seal Beach steam plant	Seal Beach, Cal.	3,840,000	One 48,000 hp. Westinghouse steam turbine
San Diego Cons. Gas & Electric Co.	Steam Station B. additional unit	San Diego, Cal.	1,610,000	One 15,000 kw. steam turbine
City of Pasadena, Cal.	Pasadena steam plant addition	Pasadena, Cal.	1,610,000	One 15,000 kw. steam turbine
Grays Harbor Railway & Light Co.	Steam Station No. 1 add unit	Aberdeen, Wash.	536,000	One 5,000 kw. Westinghouse steam turbine
Public Service Company of Colorado	Valmont add unit	Boulder, Colo.	2,680,000	One 25,000 kw. G.E. steam turbine

200 kva. Coupled with the Essex and Marion stations of the same company, the Kearny plant will furnish the energy for one of the largest generating systems of the East.

The Crawford Avenue station of the Commonwealth Edison Company, which was formally put into service on May 26 of last year, is another of the outstanding plants of the country. Its initial generator installation is 160,000 kw., consisting of two 50,000-kw. units and one 60,000-kw. unit. While the present plan calls for an ultimate rating of 750,000 kw., to cost $80,000,000, it is possible that the station may have an ultimate rating of 1,000,000 kw. and a total cost of $100,000,000. From an electrical viewpoint, the isolation and other provisions for handling the concentration of power available are the chief features of the Crawford Avenue plant.

Another large Eastern plant under construction is the East River station of the New York Edison Company. This station is laid out for an initial installation of 120,000 kw. and an ultimate capacity of 700,000 kw. It is being built to take care of an average annual growth of 10 per cent in the company's load. The new station will be interconnected with the 25-cycle system of the Edison-United companies by underground transmission lines of 11,400 volts. The Sherman Creek station has at present 40,000 kw. in 25-cycle generating equipment and the Hell Gate station 105,000 kw. The Waterside stations have 347,200 kw. capacity and the smaller stations 53,600 kw., making a total of 545,800 kw. in 25-cycle generators available.

The fourth steam-electric generating plant of the superpower class under construction during 1925 is the Richmond station of the Philadelphia Electric Company, which started up a few weeks ago, coming on the lines, as did the Kearny plant, without fuss or public ceremony. The ultimate capacity of this plant will be 600,000 kw., the initial installation being 100,000 kw. Because of its size a number of interesting problems were encountered and overcome in the design of this plant.

Table IV—Statement of Applications Filed with Federal Power Commission to November 1, 1925

	Number	Horsepower — Private Power (90% of Time)	Horsepower — Est. Ultimate Installation
Preliminary permits issued	139		
Canceled, expired or superseded by license	67		
Permits outstanding	72	2,110,715	4,926,080
Licenses issued	200		
Revoked or surrendered	7		
Licenses outstanding	193	1,447,987	3,704,043
Total cases filed	669		
Total capacity: Active cases, Nov. 1, 1924		18,122,134	30,756,219
Filed during year		3,189,565	5,364,257
Total Nov. 1, 1925		21,311,699	36,120,476
Rejected, expired, canceled or withdrawn during year		726,460	1,472,345
Net active		20,585,239	34,648,131
Conflicts		6,299,249	10,300,998
Net project capacity		14,285,990	24,347,133

Other outstanding steam-electric developments completed or begun during the past year are the Harbor Point station of the Utica Gas & Electric Company, with an ultimate development of 150,000 kw., of which the first 60,000 kw. will be put in operation during the first part of 1926; the Edgar plant of the Edison Electric Illuminating Company of Boston, with an ultimate installation of 400,000 kw.; the Yadkin station of the Southern Power Company, with an installation of 75,000 kw.—determined upon as a result of the drought and to be rushed to completion; the Avon station of the Cleveland Electric Illuminating Company, the ultimate capacity of which will be 300,000 kw.; the Columbia Park plant of the Columbia Gas & Electric Company, ultimately to be rated at 240,000 kw., and the Seal Beach plant of the Los Angeles Gas & Electric Company and the Valmont plant of the Public Service Company of Colorado, with an ultimate rating of 200,000 kw. and 100,000 kw. respectively.

A total of fifty-two hydro-electric projects were

Western Canada Proposed and Completed or Under Construction During 1925

Generators	Effective Head	Initial Capacity	Ultimate Capacity	Date of Completion	Remarks—Status of Development
Two 22,500 kva.	1,150 ft.	40,000 kw.	410,000 kw. to 520,000 kw.	Not determined	Proposed development
One 10,000 kva.	133 ft.	10,000 kva.	10,000 kva.	During 1927	Dam and tunnel completed
One 13,125 kva. G.E.	115 ft.	11,800 kw.	59,000 kw.	Sept., 1925	Covers installation of 5th unit in existing plant
Two 15,000 kva. Westinghouse	140 ft.	30,000 kva.	30,000 kva.	July, 1925	In operation
Four 20,000 kva. G.E.	1,250 ft.	80,000 kva.	120,000 kva.	Aug., 1925	In operation
Two 30,000 kva. Allis-Chalmers	120–230 ft.	60,000 kva.		Jan., 1926	Practically completed
Two 15,625 kva. Westinghouse	Max. 310, Av. 260	31,250 kva.	31,250 kva.	June, 1925	80 per cent completed
Two 6,250 kva. Westinghouse	1,050 ft.	12,500 kva.	12,500 kva.	Mar., 1925	In operation
Three 27,000 kva. G.E.	307 ft.	81,000 kva.	81,000 kva.	July, 1925	In operation
Two 13,500 kva.	228 ft.	27,000 kva.	27,000 kva.	Jan. 1925	Work under way. Plant is being built in co-operation with an irrigation district
Two 19,500 kva. G.E.	228 ft.	30,000 kw.	60,000 kw.	Nov., 1925	In operation
Three 11,100 kva. G.E.	264 ft.	33,300 kva.	33,300 kva.	Jan., 1927	Excavation for dam started
One 8,500 kva. Westinghouse	70–150 ft.	8,500 kva.	14,000 kw.	April, 1926	Under construction
One 33,000 kva. G.E.	2,243 ft.	31,000 kw.	124,000 kw.	Jan. 1927	Under construction
Two 40,000 kw.	2,290 ft.	80,000 kw.	80,000 kw.	May. 1928	Plans being prepared
One 50,000 kw. G.E. / One 3,000 kw. S. Morgan Smith		70,000 kw.	120,000 kw.	Aug., 1926	Cover additional unit, under construction
Two 500 kw. Westinghouse	115 ft.	4,000 kw.	8,000 kw.	1925	In operation
Two 15,000 kw. G.E.	124 ft.	30,000 kw.	30,000 kw.	1926	Under construction
Two 2,000 kw. G.E. / One 1,800 kw. G.E.	41 ft.	1,800 kw.	5,800 kw.	1925	In operation
Possibly five 20,000 kva.	380 ft.	100,000 kva.	100,000 kva.	Not determined	Under contract with the Washington Water Pwr. Co. Work will probably start during 1926
Two 25,000 kva.	2,360 ft.	50,000 kw.	50,000 kw.	Aug., 1927	Work under way. Plant to be purchased by Great Western Power Company
One 12,000 kw.	Low head	12,000 kw.	12,000 kw.	Probably 1926	Work started
One 6,250 kva. G.E.		3,000 kw.	8,000 kw.	1925	In operation
One 3,200 kw. G.E.	1,116 ft.	3,200 kw.	3,200 kw.	1925	In operation
One 31,250 kva.		31,250 kva.		1926	Bids called for
One 30,000 kw. Westinghouse		30,000 kw.	200,000 kw.	1925	In operation
One 18,750 kva.		21,000 kw.	45,000 kw.	1926	Proposed for 1926
One 15,000 kw.		15,000 kw.	31,000 kw.	Not determined	Proposed for 1926
One 5,000 kw. Westinghouse		1,400 kw.	6,900 kw.	1925	In operation
One 25,000 kw. G.E.		20,000 kw.	100,000 kw.	1926	Under construction

Table VI—List of Power Projects Completed in 1925 or Under Construction Under License from Federal Power Commission as of Nov. 1, 1925

Project No.	Name	Stream	State	Proposed Ult. Install Hp.	Estimated Cost	Scheduled Date of Completion	Hp. Scheduled to Be Put in Operation or Placed in Operation			Remarks
							1925	1926	1927	
20	Utah Power & Light Co.	Bear River	Idaho	21,000	$2,500,000	7–1–26	21,000			
52	City of Dothan	Choctawhatchee	Alabama	4,500	638,000	9–1–26		4,500		30,000 hp. previously installed
67	Southern California Edison Co.	San Joaquin	California	545,000	61,152,000	7–1–35				
70	Rock Creek Power Co.	Rock Creek	Montana	1,880	200,000	8–1–26		1,200		
77	Snow Mountain Water & Power Co.	South Fel	California	14,400	6,665,000	7–1–29				Cost includes about 110 miles tr. line 10,400 hp. previously installed
88	Merced Irrigation District	Merced	California	33,000	13,478,000	7–1–27			33,000	Complete project
120	Southern California Edison Co.	San Joaquin	California	195,000	13,890,000	12–31–29				105,000 hp. previously installed
155	Southern Sierras Power Co.	Snow Creek	California	3,750	656,300	12–31–27			3,750	Cost includes 4.7 miles transmission line
175	San Joaquin Light & Power Corp.	San Joaquin	California	266,000	50,970,000	6–1–29		41,000	10,000	41,000 hp. previously installed
176	Escondido Mutual Water Co.	San Luis Rey	California	1,000	260,000	9–1–26		360		640 hp. previously installed
177	Oklawaha Reclamation Farms		Florida	700	112,000	7–1–25	700			Cost includes 30 miles of transmission line
184	El Dorado Power Co.	So. Fk. American	California	100,000	8,922,319	12–31–28	28,000			
185	Southern Sierras Power Co.	Lost Cr. et al.	California	4,000	630,000	12–31–26	4,000			
201	Town of Petersburg	Crystal Lake	Alaska	1,240	103,500	12–31–25	1,240			Cost includes 16 miles of transmission line
233	Mt. Shasta Power Corp.	Pit River	California	99,000	13,041,600	12–31–26	99,000			Cost includes 8½ miles of transmission line
271	Arkansas Light & Power Co.	Quachita	Arkansas	96,000	8,055,000	7–1–36	12,000			
276	Houston Power Co.	Choctawhatchee	Alabama	4,800	508,871	10–1–27			3,600	Cost includes 3,600 hp. electric machinery
280	Wilson, F. M.	Wilder Creek	California	15	3,000	1–1–25	15			Assumed cost $200 per hp.
287	State of Illinois et al.	Fox River	Illinois	5,500	800,000	7–1–26	5,400			
309	Clarion River Power Co.	Clarion	Pennsylvania	42,500	6,460,000	9–1–27	11,000			11,000 hp. previously installed
312	Molybdenum Corporation of America		N. M.	530	67,000	7–1–27			430	100 hp. previously installed
346	Pike Rapids Power Co.	Red River	Minn.	24,000	2,380,000	7–1–26	17,400	6,600		
349	Alabama Power Co.	Mississippi	Alabama	180,000	10,000,000	9–1–26		70,000		Includes cost of 67,000 hp. of apparatus only
375	Humphreys, A. E.	Tallapoosa	Alabama	40	8,000	6–1–26		30		10 hp. previously installed. Assumed cost based on $200 per hp.
398	Garber, B. A.	Roaring Fk. Creek	Colorado	330	66,000	7–1–26		330		Assumed cost based on $200 per hp.
404	Carvey, L. H.	Kanatak Creeks	Alaska	160	40,000	12–31–26		200		Assumed cost based on $200 per hp.
437	Wheeler, E. R.	Lagoon Creek	Alaska	16	3,200	10–1–25	16			Assumed cost based on $200 per hp.
451	Humphreys, A. E.	Reuben Creek	Oregon	650	157,900	11–1–25	400			
485	Columbus Electric & Power Co.	Goose Creek	Colorado	80,000	6,500,000	12–31–26		20,000		
487	Pennsylvania Power & Light Co.	Chattahoochee	Ala. and Ga.	54,000	7,730,000	8–1–28			54,000	
492	Walker, J. E.	Wallenpaupack	Pennsylvania	400	189,500	12–31–26	400			
533	Hornung, Fred A.	Big Boulder Creek	Idaho	80	17,900	1–1–26	80			
534	Cyanide Gold Mining Co. Ltd.	Flat Creek	Montana	770	68,250	12–1–25	770			
605	Harvey, C. A.	Moyie River	Idaho	7	1,400	3–1–26		7		Assumed cost $200 hp.
615	Muncy, W. G.	Trib. to Umpqua	Oregon	20	4,000	1–1–27			15	Assumed cost $200 hp.
		Kelly's Gulch	California							
			Totals	1,780,288	$216,298,740		201,421	144,227	104,795	

under construction during 1925 with an ultimate capacity of 2,883,100 kw. Thirty-five projects operating under licenses from the Federal Power Commission were completed or were under construction on November 1. These projects involve an ultimate installation of 1,786,288 hp. at an estimated cost of $216,298,740.

Of the water-power projects not being constructed under the regulations of the Federal Power Commission, the Muscle Shoals development is the outstanding example. The Wilson Dam was completed and the first unit of 30,000 hp. was put into operation late during the summer. The initial installation of this project consists of four units of 30,000 hp. each, and its ultimate installation is to be 612,000 hp.

The largest project under construction under license from the Federal Power Commission in so far as the initial installation is concerned is the development of the Mount Shasta Power Corporation on Pit River, California, the water rights of which belong to the Pacific Gas & Electric Company. This project (Pit River No. 4) has an initial and ultimate installation of 99,000 hp. The plant will cost $13,041,600. Another large project under construction is that of the Alabama Power Company on the Tallapoosa River. This project has an initial installation of 70,000 hp. and an ultimate installation of 180,000 hp., will cost $10,000,000 and is scheduled for completion on September 1, 1926.

The largest water-power project for which a license has been granted by the Federal Power Commission is that of the Southern California Edison Company on the San Joaquin River at a cost of $61,152,000. This project has a present installation of 30,000 hp., an ultimate installation of 540,000 hp. and is scheduled for completion on July 1, 1935.

The activities of the Federal Power Commission during 1925 were extensive. On November 1, 1925, a total of 669 applications for permits and licenses had been filed with the commission. During the year projects totaling 5,364,257 hp. in ultimate installation were filed. The net ultimate capacity of the active projects on file with the commission on November 1, 1925, was 24,347,133 hp., a gain of 2,152,065 hp. during the previous twelve-month period.

7,381 MILES OF NEW HIGH-TENSION LINES DURING 1925

During 1925 a total of 7,381 circuit miles of high-tension transmission lines were constructed or under construction at a total cost of $59,309,472. This construction was distributed as follows: 220,000 volts, 204 miles; 132,000 volts, 1,435 miles; 120,000 volts, 285 miles; 110,000 volts, 1,763 miles; 88,000 volts, 135 miles; 66,000 volts, 1,701 miles; 60,000 volts, 357 miles; 57,000 volts, 69 miles; 55,000 volts, 106 miles; 44,000 volts, 284 miles; and 33,000 volts, 1,042 miles.

Central-Station Appliance Sales

"Electrical World" Survey Shows an Increase of 170 per Cent in Five Years—Gross Merchandising Business by 168 Central-Station Companies $23,577,422 in 1925—Details of Sales Policies and Basis for National Estimate

IN ORDER to obtain a definite basis upon which to draw an accurate picture of the number of household electrical appliances in use, the present degree of sales saturation, how rapidly the appliance business is growing and the general economics of central-station merchandising, the ELECTRICAL WORLD has undertaken to make a national survey of present conditions with a background of what has been done over the last five years.

Accordingly, a questionnaire asking only for specific information and figures was sent to those power companies in the United States which merchandise appliances. The 2,644 companies in the country known or believed to sell electrical appliances received the questionnaire, and of this number 1,225 replied. These included utilities of all sizes, ranging from the large metropolitan companies down to the smallest, some of which served 100 customers or less. Considering the number of questions and the kind of information requested, which involved the answering of 184 different items, a surprisingly good return was made. Out of the 1,225 questionnaires returned, it was found that 242 went into sufficient detail so that complete information could be tabulated and put upon a comparable basis.

Outstanding in the data collected is the growth in volume of the central-station companies' appliance business. During the six years 1920 to 1925 inclusive, 168 companies of all classes increased their appliance sales from $8,768,690.50 in 1920 to $23,577,422.20 in 1925. That is, the merchandising business of these companies increased during the period 170 per cent. At the same time these same companies' residential customers increased from 2,567,279 on Jan. 1, 1921, to 4,888,564 on Jan. 1, 1926. Thus in the five-year period the sale of electrical appliances by these central-station companies to their customers increased from $3.42 to $4.82 per customer, or 41 per cent.

It should be noted, of course, that these sales include only the following household appliances: flatirons, toasters, percolators, fans, heaters and radiators, vacuum cleaners, clothes washers, ironers, ranges, water heaters, refrigerators. Sales of portable lamps, incandescent lamps, fixtures, wiring supplies or other equipment have been excluded from the compilation.

It is interesting to note in this connection that the sales per customer are the smallest in the two extreme groups. In territories of more than 500,000 population sales per customer for 1925 $3.66, whereas sales in territories of less than 1,000 were $5.26, but in the group of 54 companies serving 1,000 to 10,000 population appliance sales reached a maximum of $13.47 per residential customer. In the four other groups sales ranged from $6.53 per customer up to $7.43.

To ascertain the percentage of saturation of the various appliances, companies were asked to furnish either by census or estimate the number of appliances of each kind in use on their lines. Comparatively few of the larger companies had available records that would give this information and they did not feel that they could safely make an estimate. Table IX, comprising reports from 174 companies, shows the number of appliances in use, together with the number of customers served and population of the territories reached. The present degree of appliance saturation of 174 companies which served 1,809,492 customers is as follows:

Appliances	Per Cent	Appliances	Per Cent
Flatirons	71.4	Clothes washers	20.5
Toasters	22.9	Ironers	1.4
Percolators	13.4	Ranges	2.9
Fans	18.6	Water heaters	0.7
Heaters and radiators	10.1	Refrigerators	0.5
Vacuum cleaners	31.3		

Central-station companies were also asked to give an estimate of the relative volume of appliance sales by all dealers in their territories—that is, the central-station company, electrical dealers, department stores and other miscellaneous retail stores. These estimates as given varied quite widely in different localities, ranging from as little as 2 per cent of the total sales by the central-station companies to as high as 75 or 80 per cent. The average weighted figure for all companies shows the following relative distribution of appliance sales by the four classes of dealers:

Dealer	Per Cent	Dealer	Per Cent
Central-station companies	42.5	Department stores	15.4
Electrical dealers	26.9	All other stores	15.2

Table IV shows a recapitulation of the servicing policies of 199 companies. From this it will be seen that 174 service all appliances, while only 25 do not maintain a service department.

Table I—Appliance Sales by 168 Central-Station Companies Last Six Years

Size of Cities	No. of Companies	Number of Residential Customers Served Jan. 1, 1926	1925	1924	1923	1922	1921	1920	Appliance Sales per Residential Customer	
									1920	1925
Over 500,000	10	3,105,135	$11,337,048.00	$10,116,479.60	$9,694,071.09	$7,294,409.80	$4,933,803.80	$5,347,530.10	$2.74	$3.66
100,000 to 500,000	31	1,256,702	8,357,942.50	7,155,723.00	5,791,039.80	3,722,974.70	2,797,505.00	2,691,044.90	6.54	6.65
50,000 to 100,000	15	281,939	1,839,111.90	1,253,912.25	1,097,017.05	740,208.45	481,879.65	340,490.55	3.49	6.53
25,000 to 50,000	13	98,512	635,930.86	556,048.03	520,961.85	347,678.53	164,662.45	119,102.91	2.83	6.68
10,000 to 25,000	22	89,323	664,941.20	462,887.70	353,648.70	216,274.74	139,912.96	213,627.70	4.47	7.43
1,000 to 10,000	54	53,819	725,811.84	587,211.66	512,711.10	77,410.62	70,534.80	55,058.94	3.80	13.47
Below 1,000	23	3,134	16,635.90	17,703.10	6,293.95	4,168.60	2,461.00	1,835.40	2.82	5.26
Totals	168	4,888,564	$23,577,422.20	$20,149,965.34	$17,975,743.74	$12,403,125.44	$8,590,759.66	$8,768,690.50	$3.42	$4.82

Table II—Number of Appliances Sold in Las Six Years by 132 Central-Station Companies Serving 3,194,935 Residential Customers

Size of Cities	No. of Cos.	Flatirons						Toasters					
		1925	1924	1923	1922	1921	1920	1925	1924	1923	1922	1921	1920
Over 500,000	8	96,633	87,725	88,701	82,178	28,682	27,915	18,655	17,744	15,559	13,251	5,946	4,398
100,000 to 500,000	29	43,251	53,768	44,302	21,767	12,245	12,254	8,426	9,561	7,401	3,375	1,642	1,563
50,000 to 100,000	14	9,570	10,199	7,091	4,152	2,574	1,570	2,965	2,747	977	773	453	236
25,000 to 50,000	12	3,491	3,749	3,712	1,780	777	215	396	679	662	218	137	22
10,000 to 25,000	20	3,399	2,558	2,174	1,050	918	1,154	853	871	729	284	263	326
1,000 to 10,000	38	1,826	1,658	1,079	1,166	842	609	329	306	186	126	69	34
Below 1,000	11	154	134	84	96	29	43	32	17	10	15	6	9
	132	158,324	159,791	147,143	112,189	46,067	43,760	31,656	31,925	25,524	18,042	8,516	6,588

Size of Cities	No. of Cos.	Percolators						Fans					
		1925	1924	1923	1922	1921	1920	1925	1924	1923	1922	1921	1920
Over 500,000	8	16,266	10,256	8,157	5,260	1,804	2,059	12,214	6,337	11,744	4,654	2,367	900
100,000 to 500,000	29	6,908	7,098	5,080	1,601	680	585	9,319	7,536	6,929	2,540	1,855	912
50,000 to 100,000	14	2,801	2,344	664	557	270	139	3,133	1,858	632	408	324	191
25,000 to 50,000	12	237	281	354	132	75	32	287	309	364	115	72	35
10,000 to 25,000	20	912	673	399	245	198	272	948	465	424	171	215	181
1,000 to 10,000	38	203	209	96	65	40	63	721	571	349	301	197	159
Below 1,000	11	6	2	3	7	3	0	76	47	40	36	26	19
	132	27,333	20,863	14,753	7,867	3,070	3,150	26,698	17,123	20,482	8,225	5,056	2,397

Size of Cities	No. of Cos.	Heaters						Vacuum Cleaners					
		1925	1924	1923	1922	1921	1920	1925	1924	1923	1922	1921	1920
Over 500,000	8	13,011	21,079	22,781	20,678	2,393	3,685	23,442	25,438	28,854	19,426	6,080	5,210
100,000 to 500,000	29	7,282	8,396	6,591	4,598	1,103	1,709	16,182	17,035	15,145	7,886	6,439	6,526
50,000 to 100,000	14	2,360	1,776	844	1,049	253	75	3,846	3,562	2,283	1,354	1,307	1,511
25,000 to 50,000	12	448	378	264	202	124	47	1,650	1,777	1,318	510	180	14
10,000 to 25,000	20	732	635	469	160	97	206	1,241	873	888	382	381	515
1,000 to 10,000	38	339	297	129	97	52	60	365	651	228	128	102	42
Below 1,000	11	20	5	2	2	2	2	17	11	11	7	8	8
	132	24,192	32,566	31,080	26,786	4,024	5,784	46,743	49,347	48,727	29,693	14,497	13,826

Size of Cities	No. of Cos.	Washers						Ironers					
		1925	1924	1923	1922	1921	1920	1925	1924	1923	1922	1921	1920
Over 500,000	8	10,047	12,083	10,879	9,234	3,600	2,896	1,556	1,055	880	510	270	147
100,000 to 500,000	29	10,724	10,836	8,678	3,469	1,192	1,923	1,107	553	405	122	65	159
50,000 to 100,000	14	3,686	2,980	1,606	813	467	421	211	63	32	45	53	11
25,000 to 50,000	12	1,000	1,000	951	979	117	15	91	26	14	4	3	1
10,000 to 25,000	20	874	618	685	519	303	389	73	41	9	7	4	7
1,000 to 10,000	38	408	337	134	122	88	52	44	26	11	1	1	0
Below 1,000	11	25	20	12	16	21	14	3	0	0	0	0	1
	132	26,764	27,874	22,945	15,152	5,788	5,710	3,085	1,764	1,351	689	396	326

Size of Cities	No. of Cos.	Ranges						Water Heaters					
		1925	1924	1923	1922	1921	1920	1925	1924	1923	1922	1921	1920
Over 500,000	8	2,477	1,775	1,007	1,031	456	526	186	123	114	55	10	9
100,000 to 530,000	29	8,387	7,310	4,674	1,170	535	462	683	1,346	1,142	47	2	0
50,000 to 100,000	14	1,246	811	278	69	32	19	167	76	12	5	1	0
25,000 to 50,000	12	396	82	35	25	16	0	110	3	1	2	1	0
10,000 to 25,000	20	461	390	297	145	126	103	98	83	58	42	36	40
1,000 to 10,000	38	269	238	39	32	36	24	102	47	14	12	13	6
Below 1,000	11	2	3	0	0	0	0	0	0	0	0	0	0
	132	13,238	10,609	6,330	2,472	1,201	1,134	1,346	1,678	1,341	163	63	55

Size of Cities	No. of Cos.	Refrigerators					
		1925	1924	1923	1922	1921	1920
Over 500,000	8	1,928	560	408	68	72	0
100,000 to 500,000	29	1,930	471	304	60	3	0
50,000 to 100,000	14	368	43	4	13	7	2
25,000 to 50,000	12	43	12	4	0	0	0
10,000 to 25,000	20	155	21	7	1	0	0
1,000 to 10,000	38	38	0	0	1	0	0
Below 1,000	11	2	0	0	0	0	0
	132	4,464	1,107	727	143	82	2

The central-station company's attitude toward price policy is shown in Table XIV, where 188 companies maintain list prices, whereas 26 companies reported that they followed a cut-price policy, these latter with some reservations, however, as to special sales and for the purpose of clearing stocks. Deferred payments are offered by 167 companies and 33 conduct their appliance business on a cash basis. Cash payment or 30 days is required by 21 companies, time payments of less than twelve months are offered by 88 companies, and extended payments of fifteen months or more are allowed by 54 companies. On special sales 77 companies cut prices, and 115 reported that they did not. In 70 cases some arrangement is made for dealer participation in special sales, and in 87 companies there appears to be no provision made for the dealer to join in special campaigns at reduced prices. In campaign selling 101 companies reported that they used house-to-house salesmen, and 88 apparently employ no outside crews. Fifty-five companies make use of manufacturers' sales crews and 118 do not sanction this practice.

The method of paying salesmen varies so widely that it was almost impossible to tabulate this information. Table V shows the variation in practice on this matter. Only 30 companies report payment of a straight salary, which ranges from a minimum of $60 to a maximum of $225 per month. Straight commissions are paid by 42 companies, usually with some stipulation as to drawing account. Combinations of salary and commission are paid by 43 companies. In the latter case drawing accounts are allowed and commissions range from 1½ per cent up to as much as 20 per cent.

Table III—Number of Residential Customers Year Ending Jan. 1

Size of Cities	No. of Companies	1926	1925	1924	1923	1922	1921
Over 500,000	10	3,105,135	2,883,877	2,661,822	2,326,257	2,088,836	1,952,254
100,000 to 500,000	31	1,256,702	1,133,991	1,026,748	682,094	511,802	412,331
50,000 to 100,000	15	281,939	267,540	245,163	179,486	109,502	97,533
25,000 to 50,000	13	98,512	92,008	84,301	66,995	45,890	42,083
10,000 to 25,000	22	89,323	83,300	74,096	71,837	53,418	47,711
1,000 to 10,000	54	53,819	48,004	42,742	31,084	27,278	14,487
Below 1,000	23	3,134	2,683	1,703	1,333	1,024	880
Totals	168	4,888,564	4,556,403	4,156,575	3,359,086	2,837,750	2,567,279

Table IV—Servicing Policy of Central-Station Companies

Size of Cities	Number of Companies Reporting Servicing				Financing of Service				
	All Appliances		Only Own Sales		Number of Companies Giving Free Service	Companies Charging for Service			
						Number of Companies	How Much Over Cost		
	Yes	No	Yes	No			Cost	10% Above Cost	25-30% Cost
Over 500,000	8	0	3	1	1	7	3	3	2
100,000 to 500,000	26	3	10	2	4	28	12	7	4
50,000 to 100,000	16	3	2	4	2	14	6	5	5
25,000 to 50,000	9	3	4	1	3	6	3	4	2
10,000 to 25,000	27	1	5	3	6	26	11	3	7
1,000 to 10,000	64	10	13	13	10	59	22	20	7
Below 1,000	24	5	4	1	6	22	9	6	4
	174	25	41	25	32	160	66	47	31

Table V—Payment of Salesmen

Size of Cities	Straight Salary	How Much	Commission	How Much Per Cent			Combination Salary and Commission	How Much	
		Dollars		5	10	15		Dollars	Per Cent
Over 500,000	4	150 to 200	5	0	2	3	5	100 to 150	5 to 10
100,000 to 500,000	6	125 to 225	7	0	3	4	15	40 to 150	1½ to 10
50,000 to 100,000	6	60 to 175	5	1	3	1	10	50 to 125	5 to 10
25,000 to 50,000	2	75 to 90	5	2	3	0	4	35 to 100	5 to 10
10,000 to 25,000	6	100 to 175	10	0	5	3	4	50 to 100	5 to 10
1,000 to 10,000	6	85	10	1	4	5	5	60 to 100	5 to 20
Below 1,000	0	0	0	0	0	0	0	0	0
	30		42	4	20	16	43		

Table VI—Appliance Sales by Central-Station Companies

Year	Amount 1924	Increase Over Year Previous
1920	$17,603,000	....
1921	18,613,000	5.7
1922	27,337,000	52.2
1923	40,641,000	47.8
1924	47,601,000	17.5
1925	57,451,000	21.0

Table VII—Appliance Sales by Dealers in Territories Served by Merchandising Companies

No. of central-station companies which sell appliances 2,644
No. of residential customers of above companies 8,274,900

Distribution of Appliance Sales by All Dealers:

Dealer	Amount 1924	Per Cent of Total
Central-station companies	$47,601,000	42.5
Electrical dealers	30,089,000	26.9
Department stores	17,190,000	15.4
Other stores	17,012,000	15.2
Total	$111,892,000	100.0

Appliances sales per residential customer by central-station companies	$5.44
Total appliances sales per residential customer by all dealers	12.82
Total appliances sales per 1,000 population	2,270.00

Table VIII—Amount Spent for Advertising Purposes by Central Stations Merchandising

Year	Appliance Advertising	Other Purpose Advertising
1920	$1,421,250	$1,251,430
1921	1,561,500	1,439,650
1922	1,982,600	1,542,150
1923	2,930,000	2,059,780
1924	3,572,000	2,653,185
1925	3,682,600	2,887,370

The number of appliance stores operated by central-station companies varies, of course, with the size of the city. The total of 132 companies reported an aggregate of 556 retail appliance stores.

The amount of money spent for advertising purposes was very difficult to tabulate, as a great many companies made no distinction between the amount spent in the promotion of appliance sales and that expended for good will, public policy and other purposes. Table XI shows the advertising expenditures by 101 companies for both appliance advertising and all other purposes. Some companies failed to give the actual amount expended for advertising, but estimated that on appliance advertising they allowed from 1½ to 4 per cent of their gross appliance sales. Appliance advertising appears to exceed that for all other purposes by about 25 per cent, and the actual amount of money spent for advertising purposes has more than doubled over the six-year period.

Gross appliance sales, operating expenses, overhead charges and net profit for 111 companies are given in Table X, which shows that from a money-making point of view the smaller-sized cities offer the best possibilities. Six companies operating in cities of 500,000 or more and doing a gross appliance business of $8,056,-593.71 showed a net profit of only $39,102.88, or a little less than one-half of 1 per cent. In towns of 100,000 to 500,000 a net profit of 11.4 per cent was shown, whereas in the small towns of 1,000 to 10,000 15.8 per cent profit was made. It must be recognized, of course, that there is a wide difference in the accounting methods of different companies. On a total business of $17,596,-759.50 by the 111 companies, operating expenses were $8,744,578.12 with a net profit of $1,057,551.86, or an over-all profit of 5.9 per cent.

The foregoing data compiled from the reports of the power companies may be considered as representing a

Table IX—Number of Appliances in Use by Census or Estimate

Size of Cities	No. of Cos.	Population	Customers Served	Flatirons	Toasters	Percolators	Fans	Heaters and Radiators	Vacuum Cleaners	Clothes Washers	Ironers	Ranges	Water Heaters	Refrigerators
Over 500,000	5	3,094,275	544,663	385,000	117,000	61,000	101,000	68,000	181,000	77,000	6,200	6,750	1,360	910
100,000 to 500,000	23	4,814,705	862,086	599,890	202,124	121,149	179,211	80,480	247,410	200,509	12,769	33,224	6,430	5,787
50,000 to 100,000	17	1,097,084	210,873	177,301	63,541	41,472	30,491	20,647	95,912	59,650	4,189	7,640	2,117	1,322
25,000 to 50,000	9	281,911	51,879	39,170	5,650	3,723	3,310	1,575	12,262	12,213	290	1,053	424	429
10,000 to 25,000	21	338,609	74,351	54,201	15,840	9,270	14,500	7,980	19,410	12,875	627	2,399	1,174	390
1,000 to 10,000	69	242,927	61,838	32,922	9,512	5,886	8,214	3,996	10,221	9,046	976	2,442	1,236	199
Below 1,000	30	16,442	3,802	2,359	536	465	556	147	610	732	100	47	19	25
Totals	174	9,885,953	1,809,492	1,290,843	414,203	242,965	337,282	182,825	566,825	372,025	25,151	53,555	12,760	9,062
Percentage of saturation	...	.....	.....	71.4	22.9	13.4	18.6	10.1	31.3	20.6	1.4	3.0	0.7	0.5

Table X—Gross Appliance Sales, Operating

Size of Cities	Number of Companies	1924 Gross Sales	1924 Operating Expenses, Including Overhead Charges	1924 Net Profit	1923 Gross Sales	1923 Operating Expenses, Including Overhead Charges	1923 Net Profit
Over 500,000	6	$8,056,593.71	$1,865,865.52	$39,102.88	$7,630,665.97	$1,654,540.52	$69,607.51
100,000 to 500,000	25	6,488,308.44	4,632,914.12	746,530.93	4,631,122.64	2,914,766.48	548,821.47
50,000 to 100,000	16	1,530,805.33	1,253,747.73	139,390.85	683,222.81	500,391.13	72,246.49
25,000 to 50,000	10	496,283.80	307,652.38	34,161.78	459,846.05	275,640.71	46,955.52
10,000 to 25,000	22	759,470.43	545,253.38	57,244.18	654,022.88	390,638.91	47,772.66
1,000 to 10,000	26	254,757.79	133,778.75	40,303.24	153,556.11	87,923.37	24,121.53
Below 1,000	6	10,540.00	5,366.24	818.00	1,500.00	1,200.00	300.00
	111	$17,596,759.50	$8,744,578.12	$1,057,551.86	$14,013,936.46	$5,824,401.12	$809,825.18

Table XI—Money Spent for Advertising by 101 Central-

Size of Cities	No. of Cos.	Appliance Sales 1925	1924	1923	1922	1921	1920	All Other 1925	1924
Over 500,000	8	$553,800.00	$550,575.65	$547,878.12	$456,148.44	$333,541.74	$322,945.00	$451,000.00	$453,380.00
100,000 to 500,000	18	185,187.20	184,802.51	144,129.32	56,534.54	30,644.33	33,098.98	171,842.93	156,846.78
50,000 to 100,000	12	30,583.00	27,596.27	16,816.24	10,171.05	12,484.37	6,689.63	32,217.00	30,638.26
25,000 to 50,000	11	20,399.85	27,413.75	16,508.02	12,035.05	11,699.04	8,641.13	16,824.98	22,769.13
10,000 to 25,000	20	19,715.00	20,664.17	18,250.41	12,283.43	11,110.17	9,730.06	14,500.00	11,237.00
1,000 to 10,000	26	101,900.60	75,091.44	22,035.98	1,910.21	1,768.28	924.35	90,927.00	75,361.94
Below 1,000	6	315.00	203.00	50.00	75.00	65.00	75.00	50.00	25.00
	101	$911,900.65	$886,346.79	$765,668.09	$549,157.72	$401,312.93	$382,104.15	$777,361.91	$750,258.11

fair cross-section of the household electric appliance business in those territories served by central-station companies which are merchandising appliances. Complete returns were received from 168 central-station companies serving a total of 4,888,564 residential customers, which is 33.6 per cent of the total 14,538,000 residential customers of the power companies in the United States. By actual count there are 2,644 central-station companies actively merchandising appliances, and these companies have on their lines 60.1 per cent of all the residential customers in the country. That is, there is a total of 8,733,680 residential customers on the lines of those power companies which are actively selling appliances. This leaves 5,799,320 residential customers, or 39.9 per cent of the total, in territories served by central-station companies which do not sell appliances.

It must be realized, of course, that any figures calculated to represent a national condition and based upon only a part of the whole must be allowed a certain margin of tolerance plus or minus. It is felt that extreme conservatism has been exercised in arriving at total national figures and where there have been apparent inaccuracies in the original data sheet, they have been omitted rather than include them with probable distortion of average figures. This has in every case tended to lower rather than increase total figures.

In Table XV is shown the number of electrical appli-

Table XII—Summary of Value of Appliance Sales by Central-Station Companies Merchandising—1924

Size of Cities or Territory Covered (Population Served)	Central-Station Companies Merchandising	Number of Residential Customers of Companies Merchandising (Mean for 1924)	Number of Stores of Companies Merchandising	Appliance Sales By Central-Stations Merchandising	Appliance Sales per Residential Customer	Appliance Sales—All Dealers: Central-Stations Per Cent	Electrical Dealers Per Cent	Department Stores Per Cent	Other Stores Per Cent	Total Appliance Sales in Territory Served By Central-Station Companies Which Merchandise	Total Appliance per Residential Customer	Total Appliance Sales per 1,000 Population
Over 500,000	15	3,052,000	235	$15,400,000	$4.87	45.0	20.0	16.0	19.0	$34,515,000	$10.95	$2,040
100,000 to 500,000	67	2,349,000	954	16,700,000	6.59	42.2	32.6	15.0	10.2	39,600,000	15.64	2,718
50,000 to 100,000	88	1,083,000	294	5,630,000	4.91	52.5	28.6	8.3	10.6	10,720,000	9.34	1,618
25,000 to 50,000	124	681,000	332	4,260,000	5.90	36.4	23.4	25.5	14.7	11,680,000	16.18	2,880
10,000 to 25,000	406	698,000	493	3,155,000	4.27	26.3	34.6	14.0	25.1	11,980,000	16.22	3,145
1,000 to 10,000	1,438	389,000	1,562	2,330,000	5.67	73.2	9.7	3.0	14.1	3,180,000	7.73	1,390
Below 1,000	505	22,900	502	126,000	4.98	58.1	4.3	0.0	37.6	217,000	8.98	1,694
Totals for year	2,644	8,274,900	4,372	$47,601,000	$5.44	42.5	26.9	15.4	15.2	$111,892,000	$12.82	$2,270

Table XIII—Number of Central-Station Companies Merchandising Segregated

State	Total Operating Companies: Per Cent of Companies Merchandising	Per Cent of Total Customers	Total Number of Central-Station Companies Merchandising: Number of Companies	Total Number of Customers	Under 150 Customers: Number of Companies	Total Number of Customers	151 to 400 Customers: Number of Companies	Total Number of Customers	401 to 800 Customers: Number of Companies	Total Number of Customers	801 to 4,000 Customers: Number of Companies	Total Number of Customers
United States	41.7	60.1	2,644	8,733,680	505	25,308	1,132	231,923	306	179,483	406	739,171
New England	57.0	65.5	208	865,151	23	1,114	55	10,654	24	14,436	59	121,299
Middle Atlantic	34.7	44.6	206	1,546,408	20	821	60	13,846	22	13,287	51	95,166
South Atlantic	34.3	53.3	262	514,882	53	2,794	120	24,899	28	16,586	34	54,603
East North Central	36.6	63.6	468	2,434,820	76	3,927	201	41,492	62	36,478	75	135,970
West North Central	38.6	75.2	665	1,178,814	162	8,252	308	57,224	70	38,338	78	132,574
East South Central	38.2	60.2	163	301,298	39	1,912	73	14,654	21	11,922	19	34,474
West South Central	56.3	52.6	352	452,491	67	3,621	183	39,882	36	19,956	46	86,756
Mountain	57.0	79.8	200	369,948	39	1,684	85	18,766	30	20,971	34	62,797
Pacific	52.6	68.3	120	1,069,868	26	1,183	47	10,506	13	7,509	10	15,532

Expenses, Including Overhead Charges, and Net Profit

1922			1921			1920		
Gross Sales	Operating Expenses, Including Overhead Charges	Net Profit	Gross Sales	Operating Expenses, Including Overhead Charges	Net Profit	Gross Sales	Operating Expenses, Including Overhead Charges	Net Profit
$6,113,467.67	$1,359,218.63	$155,065.03	$4,456,611.36	$947,242.26	$141,963.99	$3,427,052.00	.....	.....
2,418,229.06	1,213,388.68	234,045.43	1,950,136.09	783,270.54	116,881.82	1,120,291.83	$757,237.69	$91,563.51
345,929.81	323,830.62	49,458.19	277,523.28	315,080.79	32,409.89	385,297.13	345,258.04	26,356.09
303,748.51	179,099.54	24,995.67	120,166.80	57,759.95	15,216.89	47,863.27	34,477.29	13,385.98
412,403.39	262,542.87	26,002.75	304,733.23	184,273.79	29,668.96	256,532.82	151,343.97	22,499.47
105,798.79	60,867.96	19,981.25	79,447.26	46,018.15	18,489.74	99,431.64	66,058.06	26,495.04
1,500.00	400.00	200.00	2,000.00	400.00	300.00	2,500.00	600.00	600.00
$9,701,077.23	$3,399,348.30	$509,748.32	$7,190,618.02	$2,334,045.48	$354,931.29	$5,338,968.69	$1,354,975.05	$180,900.09

Station Companies

Purposes				No. of Cos.	Size of Cities
1923	1922	1921	1920		
$340,022.00	$285,394.00	$286,519.00	$274,242.00	8	Over 500,000
143,711.97	80,672.52	46,597.14	37,318.42	18	100,000 to 500,000
23,429.15	22,974.94	19,571.62	12,637.98	12	50,000 to 100,000
11,813.51	7,961.85	8,616.13	3,764.50	11	25,000 to 50,000
12,102.03	10,384.22	10,466.46	9,708.38	20	10,000 to 25,000
23,779.74	3,433.00	3,642.04	1,372.07	26	1,000 to 10,000
25.00	25.00	25.00	25.00	6	Below 1,000
$554,883.40	$410,845.53	$375,437.39	$339,068.35	101	

ances now in use in the United States as estimated from the figures given by central-station companies replying to the ELECTRICAL WORLD questionnaire.

The distribution of appliance sales in territories served by central-station companies which merchandise is given in Table VII. This is for the year 1924 and is based on actual sales as reported by the companies themselves. It shows the relative amount of appliance business done by the central-station companies, electrical dealers, department stores and other retail outlets. The figure of 42.5 per cent as representing the central-station companies' proportion of the total appears to be high. Actual sales by the power companies were $47,601,000, according to the data supplied. There appears, however, to be a natural tendency on the part of some central-station men to underestimate the volume of business done by other outlets. This would make the total sale of $111,892,000 in territories where power companies sell appliances low by 15 to 18 per cent. However, no correction has been made for this, but attention is called to it as a possible error.

Table VII also shows the number of residential customers of the companies, the appliance sales per residential customer by the central-station companies, and the total appliance sales by all dealers per thousand population. This shows that in the territory served by the central-station companies $12.82 of electrical merchandise was sold per residential customer in 1924, and that the total appliance sales per thousand population was $2,270.

From the data collected it is possible to draw some interesting conclusions as to trends in appliance sales. The ratio of appliance sales per residential customer to his annual bill for electric energy is on the order of 1 to 2. That is, appliance sales by all classes of dealers average $12.82 per residential customer, whereas the average bill for energy taken the country over is between $25 and $26 per year.

Only in the case of the flatiron has any appliance approached the point of saturation in the home. The figure of 71.4 per cent for this device seems lower than might be expected. Great possibilities of load building are indicated in the low saturation for ranges, 3.0 per

Table XIV—Central-Station Price Policy

Size of Cities	List Prices Maintained		Deferred Payments		Terms			Special Sales				Companies Using House-to-House Salesmen		Companies Using Manufacturer's Sales Crews	
					Cash or 30 Days	12 Months or Less	15 Months or More	Cut Prices		Dealer Participation					
	Yes	No	Yes	No				Yes	No	Yes	No	Yes	No	Yes	No
Over 500,000.....	10	0	10	0	0	5	5	3	7	6	4	8	2	4	6
100,000 to 500,000....	33	0	30	0	1	17	15	15	17	17	16	29	3	12	17
50,000 to 100,000.....	18	1	17	1	2	11	5	6	11	8	8	17	1	11	7
25,000 to 50,000.....	16	0	16	1	5	5	6	5	11	8	7	11	5	4	10
10,000 to 25,000.....	30	1	29	2	2	15	9	12	16	12	14	14	14	9	15
1,000 to 10,000.....	61	16	51	21	8	29	9	26	42	17	31	21	41	13	44
Below 1,000.....	20	8	14	8	3	6	5	10	11	2	7	1	22	2	19
	188	26	167	33	21	88	54	77	115	70	87	101	88	55	118

in Accordance with Number of Domestic Lighting Customers Served

4,001 to 8,000 Customers		8,001 to 20,000 Customers		20,001 to 40,000 Customers		40,001 to 80,000 Customers		80,001 to 400,000 Customers		Over 400,000 Customers		State
Number of Companies	Total Number of Customers	Number of Companies	Total Number of Customers	Number of Companies	Total Number of Customers	Number of Companies	Total Number of Customers	Number of Companies	Total Number of Customers	Number of Companies	Total Number of Customers	
124	722,392	89	1,148,192	44	1,305,722	23	1,218,921	14	2,503,476	1	659,092	United States
22	126,328	16	227,056	5	150,268	4	213,996	0	0	0	0	New England
23	128,512	14	174,444	8	219,068	4	204,784	4	696,480	0	0	Middle Atlantic
13	79,184	10	134,512	3	82,488	0	0	1	119,816	0	0	South Atlantic
16	100,244	24	298,816	5	145,748	3	127,801	5	885,252	1	659,092	East North Central
21	120,086	14	173,500	6	174,444	4	217,176	2	257,220	0	0	West North Central
2	12,032	3	32,972	5	141,196	1	52,136	0	0	0	0	East South Central
11	61,004	4	45,860	4	146,112	1	49,300	0	0	0	0	West South Central
6	35,072	2	24,972	2	63,044	2	142,642	0	0	0	0	Mountain
10	59,930	2	36,060	6	183,354	4	211,086	2	544,708	0	0	Pacific

cent, water heaters 0.7 per cent, refrigerators 0.5 per cent, and ironers 1.4 per cent. On these devices the surface has scarcely been scratched.

On the face of the data collected the central-station company is by far the largest single retail outlet for electrical appliances in the territories where they merchandise. The relative importance of the four principal classes of stores is indicated as follows: Central-station companies, 42.5 per cent; electrical dealers, 26.9 per cent; department stores, 15.4 per cent; other stores, 15.2 per cent.

Nearly all central-station companies maintain an appliance servicing department, 90 per cent showing that they have facilities for doing this work. Comparatively few, about 15 per cent, do this work free of charge; the remainder are about equally divided on doing the work at cost or at 5, 10 or 25 per cent above cost.

Most companies, in fact about 92 per cent, follow a general practice of price maintenance. About 85 per cent of the companies offer deferred payments on appliances and 15 per cent or less conduct this business on a cash or 30-day basis. Less than 40 per cent of the companies cut prices on special sales, and when they do about half of these provide some means of dealer participation.

The volume of central-station appliance sales is increasing at the rate of about 20 per cent per year. It is impossible even to surmise what effect the sale of domestic refrigerators and the increasing interest in the electric range will have upon their sales.

On the basis of the data already presented, it appears that the total amount of household appliance business done in this country during 1925 was at least $200,000,000 and because of the conservative method followed in arriving at this figure it is possible that the gross amount approached $250,000,000. Of this amount the central-station sales totaled $57,451,000.

Table XV—Number of Electrical Appliances in Use in the United States as Indicated by Census and Estimated Jan. 1, 1925

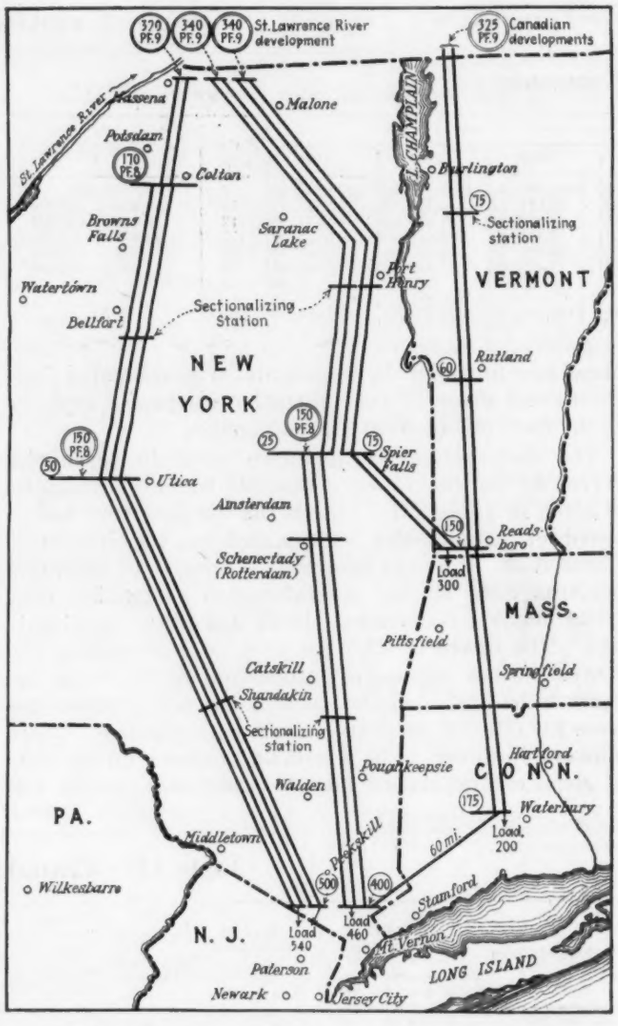
Appliance	Number in Use in Territory Served By Central-Stations Which Merchandise	Estimated Number in Use in Country as a Whole	Residential Customers per Appliance	Per Cent of Saturation
Flatirons	6,326,600	9,894,000	1.38	72.4
Toasters	2,036,300	3,108,600	4.29	23.3
Percolators	1,180,820	1,816,800	7.40	13.5
Fans	1,722,850	2,628,300	5.07	19.7
Heaters and radiators	892,200	1,320,700	9.70	10.3
Vacuum cleaners	2,816,100	4,148,600	3.10	32.2
Clothes washers	1,721,760	2,642,600	5.07	19.7
Ironers	115,770	167,020	75.5	1.3
Ranges	212,070	304,500	41.2	2.4
Water heaters	52,120	87,810	168.0	0.6
Refrigerators	40,820	66,960	212.0	0.5

Table XVI—Residential Customers Served by Power Companies in the United States

Size of City or Territory Served (Population Served)	Jan. 1, 1926		
	Number of Residential Customers of Central-Station Companies Which Merchandise	Number of Residence Customers in Territories Not Served by Central-Station-Companies Which Merchandise	Total Number of Central-Station Residential Customers
Over 500,000	3,162,568	687,432	3,850,000
100,000 to 500,000	2,524,643	75,357	2,600,000
50,000 to 100,000	1,148,192	326,808	1,475,000
25,000 to 50,000	722,392	484,608	1,207,000
10,000 to 25,000	739,171	778,829	1,518,000
1,000 to 10,000	411,406	2,643,594	3,055,000
Under 1,000	25,308	802,692	828,000
Totals for year	8,733,680	5,799,320	14,533,000

Proposed 220-Kv. Trunk Line for Eastern States

A PLAN for a 220-kv. transmission system for the utilization of hydro-electric power in New York and adjacent states was developed by the transmission lines committee of the Empire State Gas and Electric Association and was revealed at the annual meeting of that association in New York City on December 4 and 5. The proposed system is based on the estimate of



OVER 2,000,000 KW. OF SURPLUS HYDRO POWER COULD BE UTILIZED IF A COMPREHENSIVE SCHEME OF DEVELOPMENT AND TRANSMISSION COULD BE FOLLOWED

2,000,000 kw. of surplus power (which includes undeveloped resources) now available. By 1935 local demands near the power sites will have reduced this surplus to 1,800,000 kw., which will have been developed and released to extra-local markets during the ten-year period before 1935 through the proposed system or some later-designed one. This plan includes no contribution of power from Niagara Falls, as it is assumed that the local demand will absorb all available power. On the map the double circles represent generating plants, and the figures in them are thousands of kilowatts at 0.9 power factor, as are also the figures for loads. The single circles are synchronous condensers with capacities indicated in thousands of kilovolt-amperes.

High-Voltage Transmission

Reliability and Limitations Discussed—Transformers Highly Satisfactory—High Strength Insulators and Longer Spans Used in Some Sections—Line Failures and Their Causes Analyzed

By F. W. PEEK, JR.
General Electric Company, Pittsfield, Mass.

IT IS the purpose of this paper to discuss briefly the status of the elements that go to make up a high-voltage transmission system, particularly from the standpoint of reliability and limitations.

High voltages are required for transmitting large blocks of power to considerable distances. The economical use of such voltages requires a large amount of power per transmission circuit. This in turn necessitates very large apparatus units. Reliability of operation is very important not only because of the economic loss during a shutdown but also because of the possible damage resulting from a failure when so much power is involved in the large systems.

LIGHTNING IS THE GREATEST TROUBLEMAKER IN HIGH-VOLTAGE TRANSMISSION

Of all the elements making up the high-voltage system the transformer is perhaps the most highly developed. In fact, high-voltage transformers can be said to be a negligible factor as a source of trouble. The ability of transformers to withstand mechanically many tons of stress during a short circuit and hundreds of kilovolts overvoltage during lightning is the result of mechanical, electrical and chemical research by transformer engineers. The transformer presents no voltage limit to transmission. Testing transformers of the same design as power transformers have been subjected to arcing of 2,000,000 volts in the laboratory without failure. The size of transformers has increased rapidly with voltage. Single-phase transformer units have been built up to 30,000 kva. and facilities are now available to manufacture much larger units. Eventually, due to railway clearances, it will probably be necessary to take down the still larger transformers for shipment.

The duty of the circuit breaker has become very severe, but manufacturers have so far been able to keep pace with demands.

The line conductor offers no limitations to transmission at the present time. It is desirable to operate so that there is no corona loss during fair weather. When necessary, hollow conductors should afford a means of accomplishing this without undue cost. Corona undoubtedly helps to dissipate the energy of lightning and thus reduce overvoltages; however, it must be corona caused by these transient voltages. Continuous 60-cycle loss helps very little.

But a few years ago the line insulator was the source of much trouble and appeared to offer serious limitations to the extension of transmission. The insulator has been remarkably improved and may now be classed as quite reliable up to the very highest present operating voltages. This improvement has been partly due to better porcelain and methods and partly to better mechanical designs. Reliable insulators are now made that are capable of sustained mechanical loads unheard of in former units of equal size. There is now a tendency to go to greater and greater span lengths with resulting increased insulator loadings. Although this may appear economical, care should be taken not to go faster than insulator development warrants.

There is another factor that should be considered here. Long spans require higher towers. We now know that the electrical stress, in parts of the country where there is lightning, increases directly with the tower height. Thus long spans, in general, increase both electrical and mechanical stresses. Logically the number of insulator units and the tower clearance should be increased with the tower height. For long insulator strings it has been found highly desirable to use a grading ring or grading shield on the line end of the string. The purpose of the ring is to cause each unit to take its share of the operating voltage as well as of any excess lightning voltage, to remove corona from the units and in case of an arc to direct it away from the string to prevent damage to the units until the relays operate. Very long strings have "multigap" characteristics to a considerable extent. The

grading ring eliminates this undesirable feature. The insulator situation is really progressing quite satisfactorily. More will be said of arc-overs later.

The ground wire, when it can be installed under favorable conditions, is quite worthy of consideration. Recent laboratory investigations have shown that a single ground wire reduces the lightning voltages to about one-half, two to about one-third and three to about one-fourth. Thus as far as lightning voltages are concerned a ground wire has the effect of increasing the insulator strength as well as increasing the tower clearances. The extent to which the maximum efficiency can be approached in practice depends upon the possibility of keeping resistance and inductance of the ground connections low. The ground wire is also effective in case of direct strokes.

REASONS GIVEN FOR FAILURES

An element of mystery or apparent mystery always causes a lack of confidence and prevents progress. There has been such an element in transmission line failures. It is no longer necessary to ascribe troubles to "high frequency." It can be said quite definitely that insulator arc-overs result either from mechanical causes, where the insulator strength is reduced to such a low value that the normal operating voltages readily cause failure, or to excessive overvoltages. The mechanical causes of failure are confined to certain parts of the country and are generally due to dirt. Cracking at one time was also a serious cause of failure. Some one has aptly defined dirt as "matter out of place." In case of the insulator it is conducting matter out of place. Birds, for instance, have been a serious cause of trouble in the West. Such troubles are cured by bird guards or a removal of dirt.

The overvoltages that cause trouble on modern grounded neutral systems are practically confined to cloud lightning. It has been found that transients of internal origin such as those due to switching, etc., are generally harmless as far as insulators are concerned. These disturbances are highly damped oscillations or impulses, and although of the same nature as lightning, do not reach high enough voltages to cause arc-overs.

Researches in the laboratory have made it possible to estimate the maximum lightning voltage that can occur on any line. The lightning arc-over voltage of insulators and tower clearances has also been measured. By comparing the insulator and tower clearance strength with the maximum lightning voltage the ability of any line to withstand lightning can be determined. It appears that the maximum lightning voltage that can occur on any line is approximately equal to the height of the line in feet times 100,000. This maximum condition is possible only when a large cloud is very rapidly discharged in the immediate vicinity of the line, practically a direct stroke. The chances of this condition are remote. When the storm center is a quarter to a half mile away the voltage per foot or voltage gradient is greatly reduced. It may also be reduced by a slow discharging cloud permitting a considerable dispersal of the charge along the line. It has been found that apparent gradients of 20,000 to 30,000 volts per foot are fairly common on actual lines. The voltage on the line is found by multiplying the average conductor height in feet by these figures. It is thus apparent that tall towers are quite undesirable from the lightning standpoint. It is also apparent that conductors arranged in a vertical plane, because of their different heights above earth, will have lightning voltages between them as well as to ground. There will be no lightning voltage between conductors arranged in a horizontal plane. As noted above, the ground wire, when favorably installed, reduces the lightning voltage to one-half or less.

Fortunately, lightning arc-over voltages are always higher than 60-cycle arc-over voltages. Furthermore, they are not reduced by rain. Whether a line is immune from lightning failure is determined not by the operating voltage but by the tower height compared with the clearances to the tower and distance over the insulator string. Immunity, therefore, rests largely with the tower designer. The ground wire by reducing voltages has the effect of increasing clearances and adding insulators. The grading shield has important functions, and although it generally increases the lightning arc-over voltage, it cannot take the place of insulator length or tower clearance in preventing arc-overs. No shielding device can.

An example may be of interest. Assume a line with conductors in a vertical plane averaging 40, 50 and 60 ft. above ground hung by ten-unit insulator strings. With a gradient of 30,000 volts per foot, which is the highest usually observed, the lightning voltages would be respectively 1,200,000, 1,500,000 and 1,800,000 above ground on the bottom, center and top lines. Since a ten-unit insulator string has a lightning arc-over voltage of about 1,400,000, trouble would be expected on the top strings and middle strings. A shielded insulator string of fourteen units and equivalent tower clearances would not arc-over under the above conditions. With a ground wire the above voltages would be reduced and much severer storms would be necessary to cause trouble. The ground wire is equally effective in reducing stress on apparatus.

CARING FOR LIGHTNING TROUBLES

Because it may not be economical to make many lines absolutely lightning proof, it becomes important to take care of infrequent troubles with the least possible disturbances. This can be done by providing a grading and arcing ring and quick sectionalizing relays. The grading ring, as already noted, makes operating or lightning voltages divide evenly over the string, prevents concentration of voltage on the line limit, causes greater voltage stability, prevents corona at operating voltage and makes any occasional arc-over clear the string, reducing the probability of damage to the string and conductors. The top and bottom insulators of an unshielded string are usually most subject to damage—the top unit from the heat of arcs and the bottom unit from excessive voltage. The grading shield corrects both of these undesirable features.

In the above example there would be 600,000 volts between top and bottom conductors. If the conductors were arranged in a horizontal plane, the voltage above ground for the storm considered would be $30 \times 40{,}000 = 1{,}200{,}000$ on all conductors. There would be no voltage between lines. Operating information on the arc-over of insulator strings of different lengths in the different parts of the tower would be of use in determining the usual and maximum gradients to be used in estimating the lightning voltages for different localities. Data at present available from the field check the laboratory and theoretical research work very well. On one system without a ground wire apparent gradients of 20,000 to 30,000 volts per foot occurred about ten

times during a season. These values were determined by the known lightning arc-over voltages of the insulator strings and the distances of the lines above ground. Data obtained from a number of systems show by far the largest number of arc-overs on the top conductor, second largest on the top and middle conductors and minimum on all three. This is exactly what would be expected. The solution of the arc-over problem thus seems well in hand; the extent to which immunity is approached is a matter of design and economics.

The relaying problem is a very important one and deserves the best engineering attention. Certain systems in the West, where sectionalizing is accomplished without interruption of service, have shown what can be done. Prompt action on the part of the relay is also necessary to the success of the ring or horn in preventing damage from arcs.

The amount of power that a line can carry depends largely upon reactance of the circuit. If a given load is exceeded, the line becomes unstable. It is now very important to give consideration to this characteristic of transmission lines. The power transmitted must be increased with the line length to make the line economical, but the reactance increases with the line length and tends to reduce the line output. This question is being given the consideration that it deserves and a number of able papers have been written on the subject. Though it may be necessary to make certain modifications in present designs and to depart to some extent from present conventional methods of operation, it does not appear that serious limitations will be imposed.

The present 220-kv. systems are operating as well as lower voltage systems. It appears that engineering will easily be able to keep up with all future economic demands.

Industrial Control and Progress

Production Requirements Answered by Control of Motors and Industrial Processes—Special Adaptations of Control Equipments Have Been Largely Responsible for Progress Made in Industry

By N. L. MORTENSEN

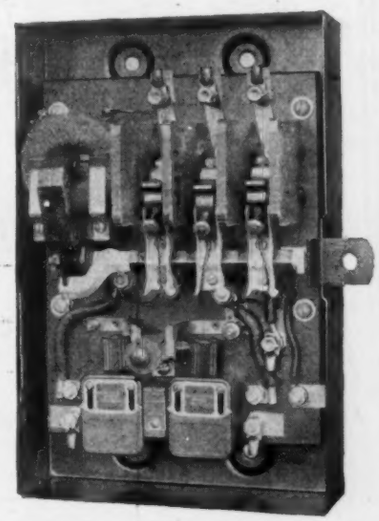
Assistant Chief Engineer Cutler-Hammer Manufacturing Company, Milwaukee

PROGRESS in industry has to a great extent been due to the discovery and application of methods and means of controlling various elements, forces and machinery. Although the outward indications of control may appear to be very elementary, the entire problem of control may become very complex when all the elements that are necessary for operation, safety and efficiency under normal and emergency conditions are taken into account.

Considering the application of electric power to machines used in industrial processes, the motors by themselves are quite inflexible in application and it is usually only through the medium of controllers that they are made to perform the duties required of them. Through this medium the energy is controlled as to quantity and time of application, so it is possible to co-ordinate the various processes in such a way as to increase production, improve the product, safeguard human life and property and reduce the human effort necessary for the production of goods.

Control equipments for electric motors can, in their simplest form, be considered to be used merely for starting, stopping and protection of motors. In their more complex form they are used to make the machines which they operate perform their specific and required functions, to co-ordinate different processes and in addition to safeguard the operators as well as protect the machines. The development of control apparatus for electric motors can, therefore, be considered along two natural lines: one performing simply starting and stopping functions for different types of motors and the other controlling machines and processes employed in different industries.

Development in motor control, during the last two years, has been practically confined to alternating-current motors owing to the continuous pressure to use such motors wherever possible. Because of the premium put on high power factor, synchronous motors are being utilized more extensively and improvements have been made in this type of motor and new types developed. Many of the characteristics of direct-current motors are not inherent to alternating-current motors, hence the problems in control development have been to provide controllers so similar results can be obtained with alternating-current motors and thus widen their scope of application. Development of controllers for new types of motors has also been an important activity.



ACROSS-THE-LINE STARTER WITH THERMAL PROTECTION AND PUSH-BUTTON CONTROL (CUTLER-HAMMER)

Among the outstanding characteristics of the direct-current motor is the dynamic braking obtainable for quick stopping. In this characteristic the alternating-current motor has been limited in the past, because this feature was not readily obtainable. Recently, however, control equipments have been developed whereby it is possible to obtain quick stopping with an alternating-current motor by applying reverse torque

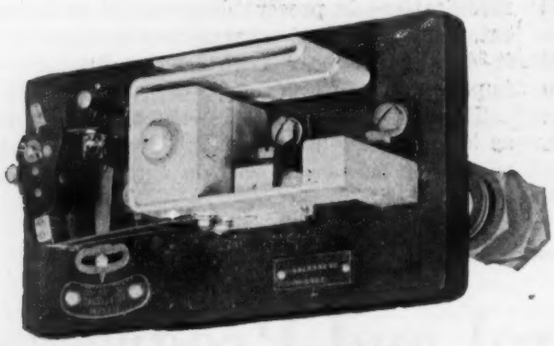
and then disconnecting the motor when it comes to a standstill. Such controllers are of the magnetic type and consist primarily of a control panel containing a couple of contactors, one for running and one for stopping, the necessary starting and stopping station, and a speed switch or governor to operate in conjunction with the stopping contactor. The motor is started in the usual manner. When the push-button station or master switch is operated for stopping, however, not only the running contactor is opened but the stopping contactor is closed, applying reverse torque to the motor. This brings the motor quickly to rest, at which time a speed switch or governor operates, opening the stopping contactor and disconnecting the motor.

This development has made squirrel-cage and slip-ring motors applicable to a number of machines in different industries, such as tire machines in the rubber industry, small printing presses, calenders, cutters and reels in the printing industry, tenter frames in textile mills and extractors in the laundry industry.

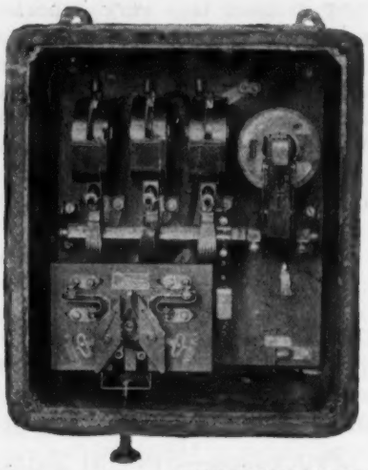
Another characteristic of the direct-current motor is that it can be operated at slow speed or slowed down by means of armature-shunt connections. Slow speed is also obtainable with the two-speed alternating-current motor, which makes it possible to use this type of motor in a number of applications where previously direct-current motors only were used. The two-speed motor has been used on elevators for a number of years and recently has come into use on cranes and small automatic hoists, such as coal and ash hoists. Today complete automatic control equipments are available for such installations, and the functions obtainable are the same as with direct-current equipments.

Development of the adjustable-speed brush-shifting type of alternating-current motor has been accompanied by development of both manual and automatic control. Although this type of motor has not as yet been generally adopted, its characteristics make it applicable for a number of different machines in various industries, and control equipment will have to be developed accordingly.

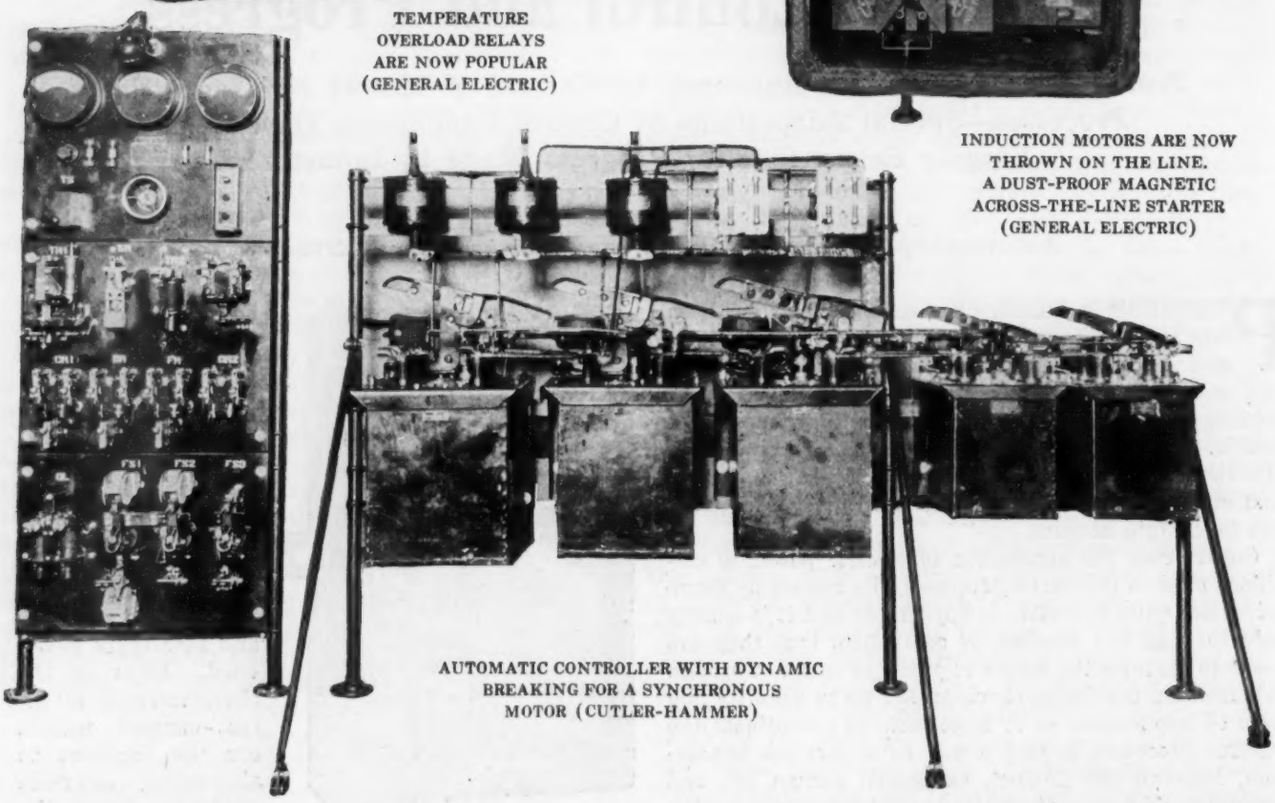
So far as synchronous motors are concerned, one of the inherent characteristics that has limited their application has been low starting torque. The general practice has been—and still exists in a number of industries—to remove the load during starting and provide a clutch to connect the motor to the load after the motor has accelerated. A recently developed motor that has improved starting characteristics and the running characteristics of a synchronous motor has made it applicable to a number of different installations requiring small or medium-size motors. Both manual



TEMPERATURE OVERLOAD RELAYS ARE NOW POPULAR (GENERAL ELECTRIC)



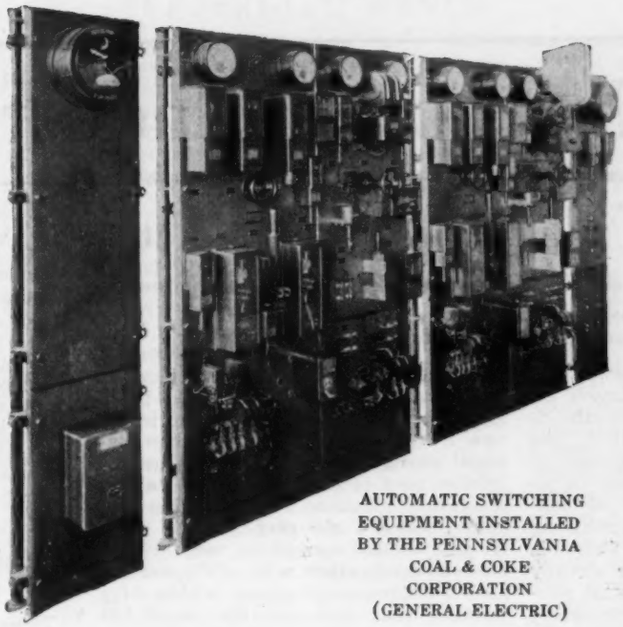
INDUCTION MOTORS ARE NOW THROWN ON THE LINE. A DUST-PROOF MAGNETIC ACROSS-THE-LINE STARTER (GENERAL ELECTRIC)



AUTOMATIC CONTROLLER WITH DYNAMIC BREAKING FOR A SYNCHRONOUS MOTOR (CUTLER-HAMMER)

and automatic controllers are now available for this type of motor.

The starting characteristics of the synchronous motor have also been constantly improved, and new motors such as the supersynchronous motor have been developed. This has made it possible to connect the synchronous motor direct to the load for a number of applications. Complete lines of control equipment, both manual and automatic, are being built to obtain the most favorable starting characteristics with different types and makes of motors.



AUTOMATIC SWITCHING EQUIPMENT INSTALLED BY THE PENNSYLVANIA COAL & COKE CORPORATION (GENERAL ELECTRIC)

With the synchronous motor, it is further possible to obtain dynamic braking. This has made this motor applicable to machines like rubber mills, where quick stopping is required in emergency. Controllers have been developed to meet this requirement. In these installations safety switches are installed in the rubber mills and dynamic braking is obtained by means of contactors which connect resistance across the motor terminals while keeping the field energized. Such controllers are all of the magnetic type.

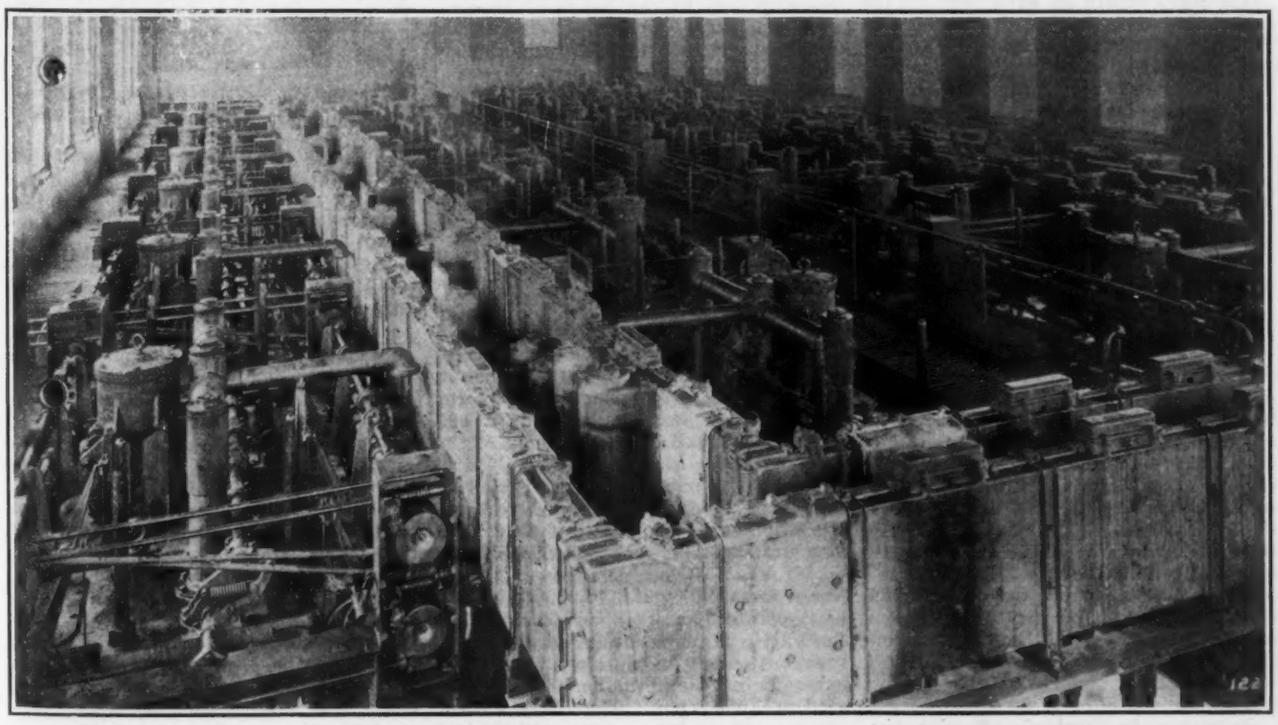
Development of control equipment for machines and processes employed in the different industries covers such a wide and extensive field that it is a very difficult and arduous task to cover the field in a brief article. In the last couple of years, particularly, the development of control and control applications has resulted in reduction in labor and increased production and improvement in manufacture. In some cases control development can be considered only a matter of refinement or improvement. In other cases it has resulted in a simplification of operations and processes to a considerable extent. In still other instances it has made possible the design and development of completely new machines.

As far as developments in the controllers themselves are concerned, safety requirements demand more and more inclosed apparatus. More or less complete inclosures are now available for all types of control apparatus. There have also been developments in protective devices, such as thermal overload, phase failure and phase reversal relays, limit switches and safety switches for different machines. There has been a marked tendency to use more and more automatic control in place of manual control. The automatic control invariably gives greater safety to the operator and also removes the human element in starting apparatus.

In the past electric controllers have been a primary essential in conjunction with electric power and heat applications. However, they have commenced to come into use in the gas industry for the control of heat units.

In large combustion processes such as coking of coal it is desirable to regulate or control the fuel gas to the ovens to give a constant flow of heat in order to maintain a uniform temperature, and recently electric controllers for total heat control have been developed.

Further development and expansion in application of electric control can be expected in this field in line with what can be expected in other industries utilizing electric power.



AN ALLIS-CHALMERS, REYOLLE ARMORED OIL CIRCUIT BREAKER INSTALLATION IN DALMARNOCK POWER STATION

News of the Industry

Congress May Tamper with Power Act

Senate Passes Unanimously Bill to Suspend for Two Years Federal Commission's Authority Over Colorado River— Tennessee and Columbia Next

FRIENDS of the water-power act are alarmed by the unanimous action of the United States Senate in suspending until Feb. 1, 1928, the "jurisdiction, power and authority of the Federal Power Commission to issue licenses for the purpose of constructing, operating and maintaining dams or reservoirs on the Colorado River and its tributaries." As already reported in the ELECTRICAL WORLD, similar legislation is likelv to be introduced suspending the operation of the water-power act on the Tennessee, and now it is rumored that the Columbia River also will be withdrawn from the jurisdiction of the Federal Power Commission if the advocates of such legislation have their way. The effect, it is contended, would be to suspend the public safeguards of the water-power act and pave the way for the surrender of national rights or for gifts of public property.

In the case of the Colorado River, the public lands committee on one day reported favorably on a joint resolution, introduced by Senator Pittman of Nevada, and the next day passed the resolution by unanimous consent. Not an inquiry as to the effect of the action was made by any member when this far-reaching legislation came before the Senate. Senator Pittman urged the passage of the measure so that no state could obtain an advantage on the Colorado River pending the ratification of the seven-state compact. He expressed the opinion that Arizona has been encouraged to stay out of the compact which the six other states have ratified "by reason of the hope of obtaining through the Federal Power Commission the rights to build dams within the State of Arizona without regard to the effect it may have upon the rights of other states."

The Pittman resolution was transmitted promptly to the House of Representatives, where it is being held on the Speaker's table pending a decision as to the committee which has jurisdiction. Some members favor the reference of the measure to the public lands committee while others think it should go to the committee on irrigation and reclamation.

Since the Senate acted before any opportunity was afforded to hear from the commission, it is expected that the real consideration of this matter will take place in the House. It is not improbable that an effort will be made in the House to amend the resolution so as to make it cover the Boulder Canyon Dam. If this be done, the measure will lose the support of the public ownership group.

Provision for making effective the Colorado River compact on ratification by six of the seven states of the basin is, as already reported, contained in the new Swing-Johnson bill. Another material change made in the measure as reintroduced is that half of the capital obligation must be repaid within five years, while 4 per cent interest is to be paid on the remainder, which is to be repaid, together with all operation and maintenance charges, within fifty years. The provision for 20,000,000 acre-ft. of storage would mean a lower dam than that recommended in the report to the Reclamation Service. The dam proposed in that report was to be 605 ft. high and provide 34,000,000 acre-ft. of storage. The bill appropriates $70,000,000, the same amount carried in the former measure.

Dr. Klingenberg Dies

Word has been received of the death of Dr. Georg Klingenberg, noted German economist and engineer, head of the Charlottenburg Hochschule and director of the Allgemeine Elektricitäts-Gesellschaft of Berlin. Dr. Klingenberg died on December 7 after a short illness. He was known in engineering circles throughout the world and last visited this country in March, 1924. His achievements were widely recognized in Germany, the government appointing him to the board of supervisors of the Physikalisch-Technische Reichanstalt and his fellow engineers electing him president of the Verband deutscher Elektrotechniker and president of the Verein deutscher Ingenieure. Professor Klingenburg was also a prolific inventor and writer of books on power-station design and the economics of power production and distribution.

Buffalo General Electric to Add a 60,000-Kw. Turbine

The rapidly increasing load supplied by the Niagara system and the necessity of maintaining a proper balance in the supply of steam and hydro power have made it necessary to add a 60,000-kw. turbine to the equipment of the River station of the Buffalo General Electric Company. The construction schedule calls for the new unit to be in operation early in the fall of 1926. The new unit will be rated at 60,000 kw., 66,667 kva., 90 per cent power factor, three-phase, 25 cycles, 12,000 volts, and will operate at a steam pressure of 250 lb. gage, a temperature of 250 deg. superheat and 1-in. absolute back pressure. It is a single-unit machine, operated at 1,500 r.p.m. The River station at present includes three 20,000-kw. besides one 35,000-kw. turbo-generator. These, as well as the large unit now to be added, are of General Electric manufacture. Directly connected to the generator terminals will be a three-phase auto-transformer of the same rating. This auto-transformer, which will also be supplied by the General Electric Company, will, the manufacturer asserts, be the largest yet constructed. It will have a higher rating and greater physical dimensions than any transformer in use now in this country.

Detroit Edison to Add 130,000 Kw. to Its Generating Plants

Three turbo-generators, aggregating 130,000 kw. in capacity, are to be added to the generating equipment of the Detroit Edison Company. Two of these machines, necessary to care for the ever-increasing demands of Detroit for power, will be placed in the Trenton Channel station and the other in the Marysville station. The turbines for Trenton Channel have capacities of 50,000 kw. each, while the Marysville unit is rated at 30,000 kw.

All of the turbines are being made by the General Electric Company. The larger units are rated at 62,500 kva., 50,000 kw., 1,200 r.p.m., 12,200 volts, three-phase, 60 cycles, with direct-connected exciter and will operate at 375 lb. pressure. Deliveries have been promised for August and October, 1926. The smaller unit is rated at 37,500 kva., 30,000 kw., 1,800 r.p.m., 12,200 volts, three-phase, 60 cycles, with direct-connected exciter, and will operate at 275 lb. pressure. Delivery will be made in July, 1926.

Advocates Legislative Probe of New York Utilities

A legislative investigation of the valuation of the property of public utilities in New York State under the principles laid down by the United States Supreme Court, as a preliminary to an effort to get legislation fixing the rates, was urged this week by Carl Sherman, former State Attorney General, in a letter to the State Conference of Mayors. Mr. Sherman said he intended to have a bill for such an investigation introduced at the coming session of the Legislature and asked the conference to support it as the most effective way to prevent rate increases.

Although he referred specifically to the recent application of the New York Telephone Company for another increase in rates throughout the state, amounting to 25 per cent, concerning which Representative Emanuel Celler of Brooklyn has declared he will ask a Congressional inquiry, Mr. Sherman said that the investigation should include the other public utilities, particularly the gas companies.

Many Ownership Changes

Electric Light and Power Properties Still Bought and Sold in All Parts of Country

CHANGES in the ownership or control of electric light and power companies in all parts of the nation continue to be reported. Some recent transfers are noted below:

The Kentucky-Tennessee Power Company has leased the Paris (Tenn.) municipal light and waterworks plant for a period of 30 years, agreeing to pay a total of $710,275 in rentals during that time and to pay $45,000 in cash at the termination of the lease, in addition to assuming a bonded indebtedness of $355,000.

Negotiations between the Mississippi Power & Light Company and Yazoo City, Miss., for the purchase by the company of the municipal light plant have progressed to the point where the only question to be settled is said to be that of price. The company has offered $190,000 for the city's light and power and water property. Yazoo City has a population of more than 5,000.

The Consolidated Gas & Electric Company of Baltimore has received permission to buy the Freedom District Electric Light Company, which operates near Eldersburg and south of Westminster. Extension of the company's service to Westminster is expected.

The Minnesota Northern Power Company of Minneapolis has purchased the United Power Company of Crosby, N. D., which supplies electricity to six communities in northwest North Dakota. The purchase was made directly by the Montana-Dakota Power Company of Williston, N. D., which will operate the United Power Company and serve the towns of Ambrose, Crosby, Flaxton, Bowbells, Kenmare and Stampede, N. D., with a power plant at Stampede, where lignite beds furnish abundant fuel.

The McComb (Ohio) Light & Service Company has been sold to the Suburban Power Company for $70,000. Possession was taken on Jan. 1.

The New York Public Service Commission has approved the purchase by the Central Hudson Gas & Electric Company of Poughkeepsie of the Wappingers Electric Corporation of Wappingers Falls. The commission's engineers and accountants fixed a valuation upon the property of $206,620 and directed that the difference between that figure and the purchase price of $300,000 be amortized over a period of years.

The Northwestern Illinois Utilities Company, a million-dollar corporation, recently organized under the laws of Illinois to acquire, maintain and operate public utilities, has purchased the People's Gas & Electric Company, with headquarters in Savanna, Ill., and is negotiating for other utility properties in northwestern Illinois and Iowa.

The Arizona Edison Company, which has purchased the ice and cold-storage plant at Florence, Ariz., is reported willing to take over the municipal light and power plant of that city. Energy is obtained from the hydro-electric system of the Salt River Valley Water Users' Association, which also furnishes power for pumping large areas around Florence and Casa Grande. This electric service may be extended along the Southern Pacific lines from Casa Grande to Tucson, where cheaper and better power is needed for agricultural needs. The Arizona Eidson Company has bought the public utility plants at Bisbee, Douglas and Yuma.

The New York Public Service Commission has authorized the merging of the Adirondack Power & Light Corporation and the Schroon Lake Lighting Corporation, the Riddell Electric Company and the Hadley Light & Power Company. The merger will result in a betterment in the electric service in Schroon Lake and Hadley.

The purchase of the electric light and water plants of Cannelton, Ind., by the Ohio River Power Company has been authorized by the Public Service Commission of Indiana. The price is $57,541. The Ohio River Company was formed for the purpose of acquiring the Cannelton property, which has been owned by the Cannelton Public Service Company.

Control of the Hanford (Cal.) Gas & Power Company has been purchased by a group composed of A. C. Balch, W. G. Kerckhoff and Ben R. Meyer, it has been announced.

Hartford's Mercury Boiler in Commission Again

The rebuilt mercury boiler of the Hartford (Conn.) Electric Light Company began productive operation again on Tuesday morning this week and is now delivering 22,000 lb. of steam per hour at 200 lb. pressure and 110 deg. superheat, while the mercury turbine is producing 1,500 kw. The mercury pressure has been raised to 48 lb. and will go higher. Commercial tests are expected in the near future.

Chamber of Commerce Firm for Private Ownership

Private ownership of public utilities was favored in a resolution adopted at the convention of the Western Division of the United States Chamber of Commerce held at Seattle on December 7 and 8. This resolution reads as follows: "At its session devoted to hydro-electric power this meeting has heard a discussion of the merits of municipally owned plants and of plants operated by private enterprise, by advocates of each system. We believe that local issues frequently take on a character which obscures the great fundamental principles which should determine the course of our industrial and political life. Among these principles is that of preserving to individuals the maximum opportunity for enterprise in industry, in order to insure to society the advantages of individual initiative. This is a cardinal principle already adopted by the National Chamber and it has our approval." A report of the session of the convention devoted to the hydro-electric situation in the West will be found in the ELECTRICAL WORLD for Dec. 12, page 1221.

Tri-State Compact Fails

New York Will Not Join with Pennsylvania and New Jersey to Regulate Transmission

WHEN the appointed delegates from Pennsylvania, New York and New Jersey met in New York City last week to consider a tri-state compact for the regulation of interstate transmission of electric power, it became evident that the scheme was not viewed with favor by the three New York representatives—Chairman Prendergast, G. R. Lunn and Chief Engineer Vanneman, all of the Public Service Commission, and they announced their withdrawal from the conference. Mr. Prendergast issued a long statement in explanation of this action, the purport of which was that such a compact is not required at this time, that New York's exports of power are relatively very small and that the problems presented can be handled adequately by the separate state commissions.

The New York men made it plain that they are in no sense opposed to such co-operation as would meet any problems that might arise concerning interstate transmission of electric power. They suggested alternatives. One of these was that the states which are desirous of co-operation enact a law similar to that prepared by the Public Service Commission of Pennsylvania and approved by the Legislature of that state, which authorizes the commission to co-operate with any official board or commission of any state of the United States in any investigations or hearing.

"Such co-operation as this," Mr. Prendergast said "would be efficacious in meeting contingencies where rate structures were affected by interstate agreements covering wholesale prices of power. The very publicity of the facts concerning cost which co-operation of the utility commissions would produce would of itself prove a deterrent to overcharges for wholesale power if such a thing were attempted. The fact is that so far in this state there have been no such cases. Publicity and competition will take care of this contingency if it arises, and a compact is a cumbersome and unnecessary cure for what is at present an imaginary evil. Nor need the fact that there have been a great many consolidations through holding companies be regarded as a danger. The operating companies whose stocks have been absorbed by the holding companies are still under the complete supervision and regulation of the state commissions as to rates and all other elements of their business."

The other alternative, Mr. Prendergast said, is to ask Congress to empower the state public service commission to regulate interstate transmission of power. "This is a clear-cut and comprehensive method," he said. "It is simpler than a compact between the states as it requires but one legislative movement—action by the Congress itself. A compact has to be approved by the legislature of each contracting state, and the form of approval must be identical in each state before Congress is called upon to act."

According to Dr. Charles Browne,

chairman of the New Jersey committee, a new plan will be submitted to the New York delegates.

New York Commission and Constitutional Amendment

Another shake-up of the personnel and administration of the New York Public Service Commission is predicted by some observers at Albany as a result of the adoption at the November election of an amendment to the constitution which compels the Legislature of 1926 to divide the functions of state government into twenty groups, group No. 16 relating to public service. One clause of the amendment reads that the heads of all boards and commissions, excepting temporary commissions for special purposes, shall be appointed by the Governor, by and with the advice and consent of the Senate, and may be removed by the Governor in a manner to be prescribed by law.

In 1921 the term of office of public service commissioners was increased to ten years and it was provided that a member of the commission could be removed by concurrent resolution of both houses of the Legislature if two-thirds of all the members elected to each house concurred. Two questions now arise: (1) How far will the present Legislature be willing to go in changing the public service commission law? (2) In the event that the Legislature leaves the existing law alone, will the Governor, by virtue of the constitutional amendment, have the right arbitrarily to remove a member of the Public Service Commission, after preference of the customary charges against him? The New York courts have held that legislative concurrence is not essential to the removal of a public officer when the statutes vest the power of removal in the Governor. In this respect the situation that will arise in New York State should any governor arbitrarily remove a commissioner differs from the situation in Pennsylvania, where the courts recently held that a provision in the public service law of that state making the consent of the Senate necessary to removal is valid.

New York State, Washington and the Lower Niagara

Significance is attached in Washington to the publication of the statement that "the New York State Water Power Commission is prepared to grant permission in the near future for the development of power in the lower Niagara River." This action by the New York commission creates the impression in Washington that a change in the water-power policy of that state may be impending. Question has been raised, however, as to the real purpose of New York in regard to the gorge development. Opinion is expressed in some quarters that the state is not so concerned in obviating possible conflict between a license issued by the state and one issued by the Federal Power Commission as it is in maneuvering matters into a situation whereby the state would have a favorable opportunity to reopen its suit against the Federal Power Commission.

The application of the Lower Niagara River Power & Water Supply Company for a preliminary permit was one of the first received after the approval of the water-power act. The company took the full three years allowed by the law to gather the necessary engineering data. Application then was made for a license, but the Federal Power Commission has not acted on this request because of the failure of the state commission to act on the application before it. In all probability the gorge license will have to be approved by the International Joint Commission as well as by the Federal Power Commission. About 200,000 hp. can, it is estimated, be developed in the remaining 100 ft. of head below the Niagara Falls Power Company site.

Extension of Park Boundary Would Hinder Development

A proposal to extend the boundary lines of Rocky Mountain National Park in northwestern Colorado is considered a serious menace to the future development of hydro-electric power in that region according to engineers familiar with the situation. President Coolidge's co-ordination committee on outdoor recreation has proposed several extensions to the park boundaries, but the most important from the standpoint of power development is a strip to the south of the present park boundary extending along the crest of the Continental Divide, lapping over from three to four miles on either side and containing approximately 60,000 acres. On the western side of the range this territory includes the headwaters of the Colorado River.

The Colorado River compact set aside 1,500,000 acre-ft. of water for Colorado, but as all of this water could not be used on the western slope of the Rockies, where it originates, a part of it would be available for conveyance to the east side by tunnels, where it could be utilized for power generation and other purposes. If, however, a part of the drainage area is placed within the boundaries of a national park, it would be difficult if not impossible to use the water for power development. A project has been considered by the Doherty engineers for tunneling under the Continental Divide and bringing the waters of the Colorado River to the east slope of the mountains, where they would be used for generating power. The scheme was abandoned for the time being because the territory was too far removed from market centers for power, but in the opinion of the investigating engineers the time is not far distant when it will be feasible to develop such a project. Any change in the present boundaries of Rocky Mountain National Park would seriously interfere with such plans and prevent the people of Colorado from utilizing their natural resources to the fullest extent.

President Lights the Nation's Christmas Tree

ONCE again the ceremony of lighting the "national Christmas tree," a giant spruce planted just south of the Treasury Building in Washington, was performed on Christmas Eve by President Coolidge to the accompaniment of chimes and carols which were broadcast by radio. In the establishment of this tree as a permanent institution the Society for Electrical Development has been the leading spirit, other interested societies lending it their aid. The picture shows the military and naval aides of the President standing respectively to the right of Mr. Coolidge and the left of his wife. Next to the naval aide are Mrs. Cecil N. Broy, head of the community center department of the Washington public schools; F. M. Feiker, vice-president of the Society for Electrical Development, and Representative Hamilton Fish, Jr.

Briefer News

Columbus, Ohio, to Improve Lighting System.—Columbus, Ohio, has in view the material improvement of its municipal lighting system. Bond issues involving $150,000 for "white way" lights in High and Broad Streets and $197,000 for a new boiler and two new substations are before the City Council.

First Unit of Trinidad (Tex.) Plant to Start Up Next May.—Rapid progress is being made in the construction of the 160,000-kw. generating station of the Texas Power & Light Company at Trinidad, near the Trinity River. It is expected that the first 20,000-kw. unit will be ready for operation in the early part of May, 1926. Three months later the second unit will be ready, and additional units will be constructed as rapidly as necessary. Unusual interest in this power plant has been aroused because of the fact that it is to use pulverized lignite for fuel.

Date Set for Kentucky Utilities Association Convention.—The annual convention of the Kentucky Association of Public Utilities will be held at the Brown Hotel, Louisville, January 15, with a dinner on the preceding night. There will be a morning and an afternoon business session, and the program will be arranged to interest public utility executives as well as operating managers. Delegates are expected from Tennessee, Virginia, West Virginia, Ohio, Illinois and Indiana to the number of about three hundred in all.

Hydro-Electric Possibilities in Oklahoma.—Charles Page of Sand Springs, Okla., chief engineer of the Page interests, has filed applications for permission to build three dams in addition to one for which an application has already been made. Two of the dams will be on the Illinois River in Adair and Cherokee Counties, Okla., and the third in Arkansas on the Illinois River. Hydro-electric power plants will be built on each of these sites, if plans are carried out, to cost a total of approximately $3,000,000, including the project heretofore announced.

New York's Affiliated Companies to Award Medals to Employees. — Announcement is made by the Consolidated Gas Company of New York on behalf of itself and the eighteen electric and gas companies affiliated with it, which include the New York Edison and United Electric Light & Power, that "meritorious service medals" in gold, silver and bronze will henceforth be awarded annually to employees for outstanding contributions to the companies' service or to the electric or gas art. The plan became effective on the first day of the year.

A New Idea in Recruiting Electrical Membership.—A complete military line-up was the organization feature of a recent membership campaign conducted by the New York Electrical Board of Trade. Under Frank W. Smith as "general" commanding, there were "colonels," "captains" and "lieutenants" in charge of the campaign, and it was decreed that those whose divisions obtained the most members were to retain their titles. Joseph Becker, commercial manager of the United Electric Light & Power Company, and Clarence Law, of the New York Edison Company, have as the result of their committees' making the best records become "colonels" and Mr. Smith retains his generalship.

Another Projected Plant for the Yadkin River. — The Carolina Power & Light Company, with headquarters in Raleigh, has obtained permission from the State Highway Commission to move the present concrete bridge at Swift Island on the Yadkin River to a new and higher site. This foreshadows the early building by the company of a new power dam 4 miles below Swift Island. The dam will, it is said, be 80 ft. high and possibly from 50,000 hp. to 60,000 hp. will be generated at the site. The company's plant at Blewett Falls, on the same stream, now generates 32,000 hp. The company has other sites and water rights on the river which will eventually give it a string of plants on the Yadkin easily co-ordinated and sufficient to supply demands for a long time to come.

Milwaukee Company Will Build 200 Miles of Farm Lines in 1926.—The Milwaukee Electric Railway & Light Company is about to launch the most comprehensive rural lines program ever attempted in Wisconsin, involving an expenditure of more than $1,000,000. Two hundred miles of such lines will be constructed in 1926 to serve between 1,200 and 1,500 farmers in Dodge, Fond du Lac, Jefferson, Kenosha, Milwaukee, Ozaukee, Racine, Sheboygan, Walworth, Washington and Waukesha Counties. Ultimately it is hoped to reach 25,000 farmers now without service. F. A. Coffin, sales manager of the company, says that under a special rural rate energy used in large quantities will be sold at 3½ cents a kilowatt-hour.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in this issue of ELECTRICAL WORLD, page 80.]

Northwest Association of Electrical Inspectors—Multnomah Hotel, Portland, Ore., Jan. 11-12. F. D. Weber, 401 Lumbermen's Bldg., Portland.

Kentucky Association of Public Utilities—Brown Hotel, Louisville, Jan. 15. E. F. Kelley, Louisville Railway Co., Louisville.

Rocky Mountain Section, N. E. L. A.—Hot Springs Hotel, Idaho Springs, Col., Jan. 25-26. O. A. Weller, Public Service Company of Colorado, Denver.

Western Association of Electrical Inspectors—Hotel Sherman, Chicago, Jan. 26-28. W. S. Boyd, 175 West Jackson Blvd., Chicago.

American Institute of Electrical Engineers—New York, Feb. 8-12. F. L. Hutchinson, 33 West 39th St., New York.

Oklahoma Utilities Association—Mayo Hotel, Tulsa, March 9-11. E. F. McKay, Suite 307, Local Bldg., Oklahoma City.

Southwestern Public Service Association—Galveston, Tex., April 13-16. E. N. Willis, 403 Slaughter Bldg., Dallas.

Southwestern Geographic Division, N. E. L. A.—Galveston, Tex., April 13-16. S. J. Ballinger, San Antonio Public Service Co., San Antonio.

National Electric Light Association—Atlantic City, N. J., May 17-21. M. H. Aylesworth, 29 West 39th St., New York.

Harrah Plant to Be Largest in Oklahoma.—When the 22,500-kw. addition already reported is made to the steam generating station of the Oklahoma Gas & Electric Company at Harrah, Okla., this plant, General Manager J. F. Owens says, will be the largest in the state, its total rating becoming 40,000 kw. Much of this power will be used in the central section of the state to supply cities on the lines of the company, which has more than 1,500 miles of transmission wires, to which nine other generating plants and 109 cities in the state are connected.

Midwestern Power Company to Operate in Utah, Wyoming, Montana and South Dakota.—Consolidation of a number of electric light and power companies in Utah, Wyoming, Montana and South Dakota under the newly formed Midwestern Power Company was recently announced. Utah, Wyoming and Chicago capital is backing the enterprise, and it is asserted that the company plans to extend its operation into other Western states. The properties owned at present or under contract for immediate purchase serve Greybull, Worland, Riverton, Hudson and Yoder, Wyo.; Edgemont, S. D., and Baker and Forsyth, Mont., and adjacent sections. H. B. Waters of Salt Lake is president and E. P. Bacon of Casper, Wyo., vice-president.

Progress Rapid on Cheat River Plant of West Penn.—Construction is ahead of schedule on the hydro-electric development of the West Penn Power Company on the Cheat River in West Virginia near the Pennsylvania state line, and the completion of the project is anticipated for September, 1926. Day and night shifts totaling more than 750 men are pushing the work on the 1,000-ft. dam. The present developed storage will be about 75,000 acre-feet in a reservoir 13 miles long. The plant will contain four 18,000-hp. turbines driving four 13,500-kw. generators at 133 r.p.m.

Court Action Asked to Prevent San Joaquin Storage Project. — Two complaints have been filed in the Superior Court at Merced, Cal., seeking to prevent the San Joaquin Light & Power Corporation from carrying out contemplated storage of the waters of the Kings River in central California in connection with its Kings River hydro-electric development. The East Side Canal & Irrigation Company lays claim to the exclusive privilege of diverting 500 sec.-ft. from the San Joaquin River, contending that the power project of the San Joaquin Light & Power Corporation will result in failure of any water to reach the irrigation company's canal at certain times. The Stevinson corporation asserts itself entitled to the natural flow of the Kings River. Neither of the complaints affects in any way the Balch plant now under construction.

Financial and Corporate

Utility Stocks Firm

Southeastern Power & Light Shares Rise Briskly on Heavy Accumulations

PRICE movements for the general lot of issues listed on the leading markets were naturally narrow at the Christmas season, although the tendency was toward slightly better rather than slightly poorer levels. Most impressive among the market developments of the week was the sudden and persistent buying that appeared in the market for Southeastern Power & Light Company's shares. These had sold below 30 not long ago and afterward climbed to 32, but advanced at the rate of a point a day once the upward movement began until the stock had reached a level nearer 40 than 35. At a price of 37½, for example, these shares thus sold on a basis equivalent to 187½ for the stock that was split five to one earlier in 1925 and, it may be added, on a basis of 375 for the old Alabama Traction, Light & Power stock, which more than a year ago was split two to one. Rumors had it that consideration was being given to some form of agreement or interchange of stock by which Southeastern would come into the control of Georgia Railway & Power Company and, incidentally, in the week that Southeastern Power & Light gathered strength the Georgia Railway & Power stock gained eleven points.

In what was only a moderately active week of trading attention turned also to the electric refrigerator stocks, Nizer and Kelvinator, each rising briskly.

New Issues Total Twelve Million Dollars.—The Illinois Power & Light Corporation this week offered first and refunding mortgage 5½ per cent gold bonds, series B, to the amount of $6,000,000. These bonds, due in 1954, were priced at 99 and interest, to yield over 5.50 per cent. The Adirondack Power & Light Corporation offered a five-million-dollar issue and the Tidewater Power Company a one-million-dollar issue.

New Refrigeration Shares Net $3,000,000 in Single Sale.—The opening sale of Electric Refrigeration Corporation stock on Monday of this week on the New York curb market was 33,400 shares at 89¾, netting more than $3,000,000. This is believed to represent the largest single trade made on the curb on the introduction of a new issue.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Thursday, Dec. 24	Low 1925	High 1925
STOCKS			
Abitibi Pwr. & Paper, com.—no par	f 76	62	76¼
Adirondack Pwr. & Lt.—7% pf.	k102	98	106
Adirondack Pwr. & Lt.—8% pf.	k107	103	115
Adirondack Pwr. & Lt., com.—50.	k 75	31	98
Ala. Pwr., pf.	k104½	97½	106
Allis-Chalmers Mfg. pf.	105	103½	109
Allis-Chalmers Mfg., com.	f 93½	71½	97½
Amer. & Foreign Pwr., pf. 25% pd.	k135	114¼	142
Amer. & Foreign Pwr., 7% pf.—no par	f 91¾	87	94
Amer. & Foreign Pwr., com.—no par	f 41½	27½	51¾
Amer Bosch Magneto, com.—no par	f 31¾	26¼	54½
Amer. Brown, Boveri, ptc., stk.	f 49	47¾	53¾
Amer Elec. Pwr., pf.	c 102	91	104½
Amer. Gas & Elec., 6% pf.—no par.	91¼	85	93
Amer. Gas & Elec., com.—no par.	78	....	....
Amer. Lt. & Trac., 6% pf.	114	....	....
Amer. Lt. & Trac., com	254	....	....
Amer. Pwr. & Lt., 6% pf.	95	....	....
Amer. Pwr. & Lt., com.—no par.	65	....	....
Amer. Pub. Serv., 7% pf.	a 96½	89	96½
Amer. Pub. Serv., com.	k 47	45	90
Amer. Pub. Utilities, 4% pf.	80	....	....
Amer. Pub. Utilities, 6% pf.	a 78	75	85½
Amer. Pub. Utilities, 7% pf.	88	....	....
Amer. Pub. Utilities, com.	80	....	....
Amer. Superpwr., pf.—25	k25	....	....
Amer. Superpwr., Class A—no par.	f 32	....	....
Amer. Superpwr., Class B—no par.	f 33½	....	....
Amer. Wtr. Wks. & Elec., 7% pf.	101	97½	103
Amer. Wtr. Wks. & Elec., com.	f 71	34¼	76½
Appalachian Pwr., 7% pf.	k101	92	100
Appalachian Pwr., 1st pf., 7%	k101	95	101
Appalachian Pwr., com.—no par.	k 78	70	83
Arizona Pwr., 7% pf.	k 83	75	87
Arizona Pwr., com.	k 30	15	34½
Arkansas Cent. Pwr., pf., $7—no par	k100	97	102
Arkansas Lt. & Pwr., 7% pf.	k 98	92	102
Arkansas Lt. & Pwr., com.	k100	65	101
Asheville Pwr. & Lt., 7% pf.	f101½	98	104
Assoc. Gas & Elec., 7% pf.—1% extra—50	f 50	....	....
Assoc. Gas & Elec., pf.—$6—no par	f 82	....	....
Assoc. Gas & Elec., Class A.	f 33½	....	....
Babcock & Wilcox, com.	f 142	....	....
Birmingham Elec. pf.—$7—no par.	k102	98	103
Blackstone Valley Gas & Elec., com.—50	95	....	....
Blaw-Knox, com.	k 59	....	....
Brazilian Trac., Lt. & Pwr., com.	f 84	....	....
Broad River Pwr., pf.	k 93	90	97
Brooklyn Edison, com.	f 136½	120½	156½
Buffalo Gen. Elec., com.—no par.	k 58	50	77
Buffalo, Niagara & East. Pwr., pf.—25.	j 24	....	....
Buffalo, Niagara & Eastern Pwr., com.—no par.	j 33½	....	....
Carolina Pwr. & Lt., pf.—$7—no par.	k104	100	107
Carolina Pwr. & Lt., com.	k430	290	456½
Central & S. W. Utilities, 7% pf.—no par.	a 90	88	90½
Central & S. W. Utilities, pr. In. pf.—no par.	c 98½	96½	100
Central Ariz. Lt. & Pwr., pf.	k101	100	106
Central Ark. Ry. & Lt., 7% pf.	k 96	91	98½
Central Ill. Pub. Serv., 6% pf.	a 88½	83	91½
Central Ind. Pwr., 7% pf.	a 89½	86	93
Central Pwr. & Lt., pf.	k 94½	88	96½
Central States Elec., 7% pf.	k 94	87	98
Central States Elec., com.	k210	70	250
Century Elec. com.	k103	103	110
Chicago Fuse Mfg., com., no par.	a 33	27½	39½
Cincinnati Gas & Elec., com.	g 89½	82	90
Cities Service, 6% pf.	84	....	....
Cities Service, pf. B—10.	7½	....	....
Cities Service, pf. BB—100.	76	....	....
Cities Service, com.—20	38	....	....
Cities Service, Bks. Shrs.—10	19	....	....
Cleveland Elec. Illg., 6% pf.	k102	101	105
Cleveland Elec. Illg., com.	k240	200	250
Colorado Pwr., 7% pf.	k 96	93	98
Columbia Gas & Elec., 7% pf.	f113½	104½	113½
Columbia Gas & Elec., com.—no par.	f 83½	45½	86
Columbia Ry., Gas & Elec., 6% pf.	k 90	90	90
Columbus Elec. & Pwr., 2d pf.	k100	....	....
Columbus Elec. & Pwr., com.	f150	....	....
Columbus Ry., Pwr. & Lt., pf. A.	k 98	86	99
Columbus Ry., Pwr. & Lt., pf. B.	k 92	80	85
Columbus Ry., Pwr., & Lt., com—no par.	k 82	70	85
Commonwealth Edison, com.	a139½	130½	141½
Commonwealth Pwr., 6% pf.	86½	....	....
Commonwealth Pwr., com.—no par.	39	....	....
Conn. Lt. & Pwr., 8% pf.	k118	115	118
Conn. Lt. & Pwr., 7% pf.	k111	105	110
Cons. Gas of N. Y., pf.—50	f 57	....	....
Cons. Gas of N. Y., com—no par.	f 95½	74½	97
Cons. Gas Elec. Lt. & Pwr. of Balti., 6% pf.	c103½	102	105
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf.	c108½	105	110½
Cons. Gas, Elec. Lt. & Pwr. of Balti. 7% pf.	c110½	109	114
Cons. Gas, Elec. Lt. & Pwr. of Balti. 8% pf.	c123½	122	127½
Cons. Gas, Elec. Lt. & Pwr. of Balti. com.—no par.	c 44	32	47½
Cons. Utilities of Dela., 7% pf.	k 85	80	84
Consumers Pwr., 6% pf.	k 95	90	97
Consumers Pwr., 6 6% pf.	k100	97	102
Continental Gas & Elec., 7% ptc. pf	k 94½	85	97
Continental Gas & Elec., 7% pr. pf.	k 94½	89	97
Continental Gas & Elec., com. no par	k145	77	152
Crocker Wheeler, com.	k43	14	28
Crocker Wheeler, pf.	k48	47	80
Dallas Pwr. & Lt., 7% pf.	k102	100	102½
Dayton Pwr. & Lt., 6% pf.	k 95	88	100
Dayton Pwr. & Lt., com.	k420	180	460
Detroit Edison, com., ex. div.	d138	110	159½
Dubilier Condenser & Radio, com.	f 84	....	....
Dubuque Elec., 7% pf.	k 91	80	90
Duquesne Lt., 7% pf.	113½	105	113½
East. Tex. Elec., 7% pf.	k100	100	105
East. Tex. Elec., com.—no par.	k 80	70	75½
Edison Elec. Illum. of Boston, com.	d208½	200	213
El Paso Elec., com.	f 78	....	....
El Paso Elec., pf.	f100	....	....
Elec. Bond & Share, 6% pf.	j103½	101½	106½
Elec. Bond & Share Sec., com.—no par.	j 67½	56½	80½
Elec. Investors, 6% pf.—no par.	k 92	95	96
Elec. Investors, com.—no par.	k 67	30	79½
Elec. Investors, 10% pd. receipts.	k 42	15	62
Elec. Pwr. & Lt., ctfs. pf.	f 93	89½	94½
Elec. Pwr. & Lt., ctfs., 40% pd.	f107½	100	110
Elec. Pwr. & Lt., ctfs. full pd.	106	100½	110½
Elec. Pwr. & Lt., ctfs., com.	f30½	17½	40½
Electric Refrigeration, w. i.	f91½	....	....
Elec Ry. Securities, com.—no par.	5½	....	....
Elec. Storage Battery, com.—no par	f 74½	60½	80
Elmira Wtr., Lt. & R.R., 7% pf.	k 96	93	98
Emerson Elec., pf.	k101	95	101½
Empire Dist. Elec., 6% pf.	k 80	78	85
Engr. Pub. Serv., pf.—no par.	k 99	100	103
Engr. Pub. Serv., com.—no par.	k 24	19½	30
Eureka Vacuum Cleaner, com.—no par.	f 53½	48½	57½
Fairbanks Morse, com.	f 51½	32½	54½
Fairbanks Morse, pf.	k108½	106½	110½
Federal Lt. & Trac., com.	f 35	26	37½
Federal Light & Traction, pf.	k 85½	82½	86½
Federal Utilities, pf.	f 75	....	....
Federal Utilities, com.	f 17	....	....
Ft. Worth Pwr. & Lt., 7% pf.	j105	99½	107½
Galveston-Houston Elec., 6% pf.	k 64	70	75
Galveston-Houston Elec., com.—no par.	d 22	17	38
Gen. Elec., com.	f333	227½	337½
Gen. Elec., special—10	f 11½	10½	11½
Gen. Gas & Elec., 6% pf.—no par.	k100	72	240
Gen. Gas & Elec., 7% pf.	k100	120	175
Gen. Gas & Elec., com.—no par	k100	72	240
Gen. Gas & Elec., (Me.) pf.—$7—no par	k100	90	175
Gen. Gas & Elec., (Me.) pf.—$8—no par.	k107	104½	180
Gen. Gas & Elec. (Del.) com. A no par.	k 58½	42	64½
Gen. Gas & Elec. (Del.) com. B no par.	k 51	40	62
Gen. Gas & Elec. (Del.) A pf. 7% no par.	k95	97½	100
Gen. Gas & Elec. (Del.) A pf. 8% no par.	k105	90	111
Gen. Gas & Elec. (Del.) B pf. 7% no par.	k 94	88	97½
Ga. Lt., Pwr., & Rys., 6% pf.	k 75	74	85
Ga. Lt., Pwr. & Rys., com.	k 55	25	74
Ga. Ry. & Elec., 5% pf.	k 70	78½	84½
Ga. Ry. & Elec., com.	k126	115½	115½
Ga. Ry. & Pwr., 8% pf.	f112½	....	....
Ga. Ry. & Pwr., 7% pf.	f100½	....	....
Ga. Ry. & Pwr., 4% pf.	k132	62	140
Ga. Ry. & Pwr., com.	k135	62	145
Gt. Western Pwr., 7% pf.	h101½	....	....
Havana Elec. Util., com.	45	42	45
Havana Elec. Util., pf.	k 69½	66	70½
Hurley Machine, com.—no par.	a 53½	41½	56
Idaho Pwr., 7% pf.	k101	97½	102
Ill. No. Utilities, 6% pf.	a 91	85	92½
Ill. Pwr. & Lt., 7% pf.	k96½	92½	98
Int. Combustion Engr., com.—no par.	f 65½	31½	69½
Int. Utilities, class A—no par.	39	32½	40
Int. Utilities, class B—no par.	k 7½	....	....
Interstate Pwr., pf., $7, no par.	k 90	90	98
Interstate Pub. Serv., 7% pf.	k 96	90	100
Iowa Ry. & Lt., 7% pf.	k 97	92	100
Jersey Central Pwr. & Lt., 7% pf.	k 94	90	96
Jersey Central Pwr. & Lt., com.—no par.	k 45	15	50
Johns-Manville, com.—no par.	f152½	....	....
Kansas Gas & Elec., 7% pf.	j100½	97½	103
Kelvinator Corp., com.—no par.	f 89½	....	....
Kentucky Hydro-Elec., pf.	a 93	85½	94
Kentucky Sec., 6% pf.	k 75	67	78
Kentucky Sec., com.	k 90	77	100
Kentucky Utilities, 6% pf.	k 89	82	95
Keystone Pwr. & Lt. 7% pf.	k 94½	90	95
Kings County Ltg., 7% pf.	k 99	....	....
Kings County, Ltg., 8% pf.	k104	103	106
Laclede Gas Lt., com.	f159½	110½	178
Lehigh Pwr. Sec., cap.—no par.	183	....	....
Long Island Ltg., 7% pf.	k105	100	105
Long Island Ltg., com.—no par.	k135	60	142
Los Angeles Gas & Elec., 6% pf.	k 95	90	98
Manila Elec., com.—no par.	33	28½	49½
Maytag Mfg., com.	f 22	21½	26½
Memphis Pwr. & Lt., pf., $7, no par.	k102	98½	102
Metropolitan Edison, pf.—$6—no par	k92	92	96
Metropolitan Edison, pf., $7, no par.	f104	....	....
Middle West Utilities, 7% pf.	a 98½	91½	98½
Middle West Utilities, 7% pr. lien pf.	a107	98	108

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco. dBid, low, high, Monday, Dec. 28. jBid, low, high, Tuesday, Dec. 29. kLatest quotations available.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Thursday, Dec. 24	Low 1925	High 1925
STOCKS—Continued			
Middle West Utilities, com.—no par	a115½	92½	125
Midland Utilities, pr. ln. pf.	a100½	98½	101
Midland Utilities pf. A	a 96	92	97
Milwaukee Elec. Ry. & Lt., 8% pf.	k100	98	105
Milwaukee Elec. Ry. & Lt., 7% pf.	k98	96	105
Milwaukee Elec. Ry. & Lt., 6% pf.	k87	83½	87
Minn. Pwr. & Lt., 7% pf.	f101	97¼	102
Miss. Pwr. & Lt., pf.	f100	....	....
Miss. River Pwr., 6% pf.	d 95	87½	96½
Miss. River Pwr., com.	50	....	....
Montana Pwr., pf.	k115½	109	117
Montana Pwr., com.	f 78½	64	99½
Montreal Pwr., com.	f 219½	....	....
Mountain States Pwr., pf.	f 94	....	....
Mountain States Pwr., com.	f 26	....	....
National Carbon, com.	f 124	120	130
National Carbon, pf.	a126	120	130
National Elec. Pwr., pf.	k 94½	94	96½
National Lt., Ht. & Pwr., 5% pf.	k 71	40	72
National Lt., Ht. & Pwr., com.—no par	k24	11	30
National Pwr. & Lt., pf., $7—no par	k102½	....	....
National Pwr. & Lt., com.—no par.	k145	185	467
National Pub. Serv., 7% pf.	k 94	....	....
National Pub. Serv., pfc. pf.	k 94	....	....
National Pub. Serv., A com.—no par	22½	22	30
National Pub. Serv., B com.—no par	13½	13½	20
Nebraska Pwr., 7% pf.	f103½	98½	103½
Nevada-Calif. Elec., com.	30	29	58
N. J. Pwr. & Lt., 7% pf.	k105	92	102
New Orleans Pub. Serv., 7% pf.	k101	94	102
New Orleans Pub. Serv., com.—no par.	k 30	31	38½
N. Y. Central Elec., 7% pf.	k97	96	101
Niagara Falls Pwr., 7% pf.—25	28½	27½	29
Niagara, Lock. & Ont. Pwr., 7% pf.	k106	101½	110
Niagara, Lock. & Ont. Pwr., com.—no par.	k 60½	60	73
Nizer Corp., A.—no par.	84½	37	84½
Nizer Corp., B.—no par.	f 90	....	....
No. Amer., 6% pf.—50.	f 49½	46½	50½
No. Amer., com.—10.	f 65	41½	75
No. Caro. Pub. Serv., pf.—$7—no par.	f94	....	....
No. N. Y. Utilities, 7% pf.	f102½	....	....
No. Ohio Pwr., com.—no par.	f 16½	....	....
No. Ohio Trac. & Lt., 6% pf.	k 73	64	75
No. Ont. Lt. & Pwr., pf.	f 75	....	....
No. Ont. Lt. & Pwr., com.	k 48	41	52
No. States Pwr., 7% pf.	100	....	....
No. States Pwr. com.	132	....	....
No. Texas Elec., 6% pf.	55	....	....
No. Texas Elec., com.	40	....	....
Ohio Gas & Elec., 7% pf.	k 90	87	100
Ohio Pwr., 6% pf.	k 92	85	95
Ohio Pub. Serv., 7% pf.	k 98	97	100
Ohio River Edison, 7% pf.	k 96	93½	100½
Oklahoma Gas & Elec., pf.	f 91	....	....
Pacific Gas & Elec., 6% pf.	98	....	....
Pacific Gas & Elec., com.	f 130	102½	137½
Pacific Pwr. & Lt., 7% pf.	f 99	97½	102
Parr Shoals Pwr., 6% pf.	k 92	90	100
Penn Central Lt. & Pwr., pf.—no par	c 73	60	73
Penn-Ohio Elec., 7% pf.	k 93	83½	96
Penn-Ohio Pwr. & Lt., 7% pf.	k 97	91	100
Penn-Ohio Pwr. & Lt., 8% pf.	k102	101	110
Penn Pwr. & Lt.-$7-no par ex. div.	f103½	98½	106½
Penn Pub. Serv., 7% pf.	k 96	90	100
Penn Pub. Serv., 6% pf.	k 85	80	90
Penn Wtr. & Pwr., com.	f 158	127	187
Phila. Co., (Pitts.) pf.—50	k 48	37½	49½
Phila. Co., (Pitts.) com.—50	f 67½	51½	67½
Phila. Elec., com.	c 53	37½	57
Pittsburgh Utilities, pf.	f 15½	12½	17½
Portland Elec. Pwr., 7% pf.	k 95	95	99
Portland Elec. Pwr., 6% pf.	f 72	....	....
Portland Elec. Pwr., com.	f 45	....	....
Portland Ry., Lt. & Pwr., pf.	k 72	....	....
Portland Ry., Lt. & Pwr., com.	k 41	....	....
Pwr. Corp. of N. Y., 7% pf.	k110	96	112
Pwr. Corp. of N. Y., com—no par	f 78½	....	....
Pwr. Sec., pf.—no par.	19	....	....
Pwr. Sec., com.—no par.	8	....	....
Pub. Serv. of N. J., 7% pf.	f105½	99	106
Pub. Serv. of N. J., 8% pf.	115	109	119
Pub. Serv. of N. J., com—no par.	f 80½	108½	87½
Pub. Serv. of No. Ill., 6% pf.	a101	92	101
Public Serv. of No. Ill., 7% pf.	a109½	102	111
Pub. Serv. of No. Ill., com.—no par	k131	107½	132½
Pub. Serv. of No. Ill., com.	a130	118	130½
Pub. Serv. Elec. & Gas, 7% pf.	f 98	92½	100½
Puget Sound Pwr. & Lt., 7% pf.	k106	102½	107
Puget Sound Pwr. & Lt., 6% pf.	84	....	....
Puget Sound Pwr. & Lt., com.	50	....	....
Radio Corp., of Amer., pf.—50	f 45½	45½	54
Radio Corp. of Amer., com.—no par	f 44½	39½	77½
Republic Ry & Lt., pf.	92	....	....
Republic Ry. & Lt., com.	66½	....	....
Rochester Gas & Elec., 5% pf.	k 95	80	98
Servel Corp., Class A	f 30	....	....
Servel Corp., Class B—no par	k 58	35	62½
Sierra Pacific Elec., com.	f 25	....	....
Sioux City Gas & Elec., 7% pf.	f 99	....	....
Southeastern Pwr. & Lt., 7% pf.—no par.	k 97	90	100
Southeastern Pwr. & Lt., com—no par	k37½	28½	37½
So. Calif. Edison, 8% pf.	130	....	....
So. Calif. Edison, 7% pf.	111½	104½	113½
So. Calif. Edison, 6% pf.	98½	88	99½
So. Calif. Edison, com.	125	....	....
Southern Cities Utilities, 7% pf.	k 84	77	100
Southern Cities Utilities, com.	k 40	30	71
Southern Pwr. & Lt. of Md., pf.	f107	....	....
Southern Pwr. & Lt. of Md., com.	f 32	....	....
Southwestern Pwr. & Lt., A	f 53	....	....
Southwestern Pwr. & Lt., B	f 40	....	....
Southwestern Pwr. & Lt., 7% pf.	f 99	....	....
Springfield (Mo.) Ry. & Lt., 7% pf.	k 96	92	93
Standard Gas & Elec., 8% pf.	k 54	50½	56½
Standard Gas & Elec., 7% pf.	100	....	....
Standard Gas & Elec., com.—no par	f 56½	40½	61
Standard Pwr. & Lt., 7% pf.	f 88½	....	....
Superheater, com.—No par.	f144	....	....
Tampa Elec., com.	f292	....	....
Tenn. Elec. Pwr., 6% pf.	f 87	....	....
Tenn. Elec. Pwr., 7% pf.	99	....	....
Tenn. Elec. Pwr., pf.—$6—no par.	k 80	72	84
Tenn. Elec. Pwr., com.—no par.	k 65	....	....
Tex. Pwr. & Lt., 7% pf.	j102½	99½	106
Tide Water Pwr., 8% pf.	f 98	....	....
Timken Roller Bearing, com.	f 54½	37½	59½
Toledo Edison, 8% pf.	k110	109	114
Toledo Edison, 7% pf.	k101	94	101½
Toledo Edison, com.	k 25	21	25
Tri-City Ry. & Lt., 6% pf.	k 87	82	85
United Gas & Elec., 6% pf.	k 90	80	94
United Gas & Elec., com.—no par.	55	25	57½
United Gas & Elec. (N. J.), 5% pf.	k 65	55	65
United Gas Impr.—50.	c117½	79½	120½
United Lt. & Pwr., pf.—$4—no par	k 53	41	51
United Lt. & Pwr., pf.—$6.50—no par.	k 92	83	99
United Lt. & Pwr., com., A—no par.	137	44½	167
United Lt. & Pwr., cl., B—no par.	17½	17½	17½
Utah Pwr. & Lt., 7% pf.	j 99	97½	101½
Utica Gas & Elec., 7% pf.	f104	....	....
Utica Gas & Elec., com.	200	100	200
Utilities Pwr. & Lt., 7% pf.	k 92	90	97
Utilities Pwr. & Lt., com. B—no par	17	16½	21½
Vermont Hydro-Elec., 7% pf.	k 92	87	96
Virginia Pwr., 7% pf.	k100	94	107
Virginia Pwr., com.	k 65	65	92
Virginia Ry. & Pwr., com.	k149	64½	150
Wagner Elec., pf.	b 82	79	92
Wagner Elec., com.—no par	b 36½	26½	50
Washington Wtr. Pwr., com.	k132	110	140
West Mo. Pwr., 7% pf.	94	....	....
West Penn., 7% pf. tem. ctf	95	94	100
West Penn Elec., class A, w. i.	89	84½	89
West Penn Elec., pf.	97	97	97
West Penn. com.	f124	97	145
West Penn Pwr., pf.	k108½	104	111
West Virginia Lt., Ht. & Pwr., 7% pf.	k 94	94½	96½
West Va. Utilities, 7% pf.—50.	k 42	38	47
Western Pwr., 7% pf.	98½	86½	99
Western Pwr., com.—no par.	k 80	34	102
Western States Gas & Elec., 7% pf.	f 88	....	....
Western States Gas & Elec., com.	f 19	....	....
Westinghouse Elec. & Mfg., com.—50.	f 75	66½	84
Weston Elec. Instrument, Cl. A.	28½	19½	28½
Weston Elec. Instrument, com.	f 18	9½	20½
Wis.-Minn. Lt. & Pwr., 7% pf.	k 90	92	95
Wis. Pwr., Lt. & Ht., 7% pf.	k 85	85	90
Worthington Pump, pf. A	77½	76	88
Worthington Pump, pf. B	62	58	76½
Worthington Pump, com.	f 44½	35½	79½
Yadkin River Pwr., 7% pf.	j103	98	106
Yale & Towne, com.—25.	61½	62	70½
BONDS			
Abitibi Pwr. & Paper	6s 1940	k100	98	101½
Adir. Elec. Pwr.	5s 1962	k100	97½	101
Adir. Pwr. & Lt.	6s 1950	f105	....	....
Adir. Pwr. & Lt.	5s 1930	k 97	94	98
Ala. Pwr.	5s 1946	k 98½	96	100
Ala. Pwr.	5s 1951	k 95½	92½	97½
Ala. Pwr.	6s 1951	k104½	101½	105
Ala. Trac. Lt. & Pwr.	5s 1962	k107	86	109
Aluminum Co. of Amer.	7s 1933	k106½	106½	107½
Amer. Bosch Magneto	8s 1936	k103	86	101
Amer. Gas & Elec.	5s 2007	92½	87	94
Amer. Gas & Elec.	6s 2014	97	....	....
Amer. Pwr. & Lt.	6s 2016	95½	....	....
Amer. Pub. Serv.	6s 1942	k98½	94	99½
Amer. Wtr. Wks. & Elec.	5s 1934	96½	92½	98
Amer. Wtr. Wks. & Elec.	6s 1975	94½	94½	95
Anaconda Copper	6s 1929	102½	....	....
Anaconda Copper	6s 1953	101½	99½	102
Anaconda Copper	7s 1938	105½	99½	105½
Appalachian Pwr.	5s 1941	k 98	96	99½
Appalachian Pwr.	6s 2024	k92½	86½	94½
Appalachian Pwr.	7s 1936	k105½	105½	106½
Arizona Pwr.	6s 1933	k100	97½	101
Arizona Pwr.	6s 1947	k 95½	90	96
Ark. Central Pwr.	6s 1948	k100½	98½	102½
Ark. Lt. & Pwr.	6s 1945	f103	....	....
Ark. Lt. & Pwr.	6s 1954	f 98	....	....
Assoc. Gas & Elec.	6s 1965	94½	92	96
Assoc. Gas & Elec.	6½s 1954	100	....	....
Binghamton Lt., Ht. & Pwr.	5s 1946	k 98½	94½	99
Birmingham Elec.	6s 1954	k101½	99	103
Birmingham Ry., Lt. & Pwr.	4½s 1954	k 87½	85	89½
Broad River Pwr.	6½s 1934	k100	99	102
Brooklyn Edison	5s 1949	102½	99½	103
Brooklyn Edison	6s 1930	104½	103½	106
Buffalo Gen. Elec. 1st	5s 1939	k101½	100½	102
Buffalo Gen. Elec. 1st & Ref.	5s 1939	k101	100	100½
Burlington Ry. & Lt.	5s 1942	k 94½	90	96
Butte Elec. & Pwr.	5s 1951	k100	99	100½
Calif. Gas & Elec.	5s 1937	100½	98	101½
Canadian Lt. & Pwr.	5s 1949	k 42½	36	62
Canton Elec.	5s 1937	k 99½	99	100½
Carolina Pwr. & Lt.	5s 1938	k100	98½	100½
Carolina Pwr. & Lt.	6s 1953	k104½	103½	105
Cedar Rapids Mfg. & Pwr.	5s 1953	k 99½	98½	100½
Central Ark. Ry. & Lt.	5s 1928	k 99½	98½	100
Central Ga. Pwr.	5s 1938	k 96	93	97
Central Ill. Lt.	5s 1943	k*98½	94	99½
Central Ill. Publ Serv.	5s 1952	k 89½	84½	92½
Central Ill. Pub. Serv.	5½s 1950	k 96	96½	98
Central Ill. Pub. Serv.	6s 1944	k100	96½	101½
Central Ind. Pwr.	6s 1947	k 98	95½	99½
Centralia. Pwr. & Lt.	6s 1944	k 99½	97	100½
Central N. Y. Gas & El.	5s 1941	k 96½	94	97½
Central Pwr. & Lt.	6s 1946	f100½	....	....
Central Pwr. & Lt.	6½s 1952	f101	....	....
Central States Elec.	5s 1926	k 99	98	102½
Chattanooga Ry. & Lt.	5s 1956	k 84	81	85
Cincinnati Gas & Elec.	5s 1956	102	98½	102½
Cincinnati Gas & Elec.	5½s 1967	103½	100½	105
Cities Service	6s 1966	92½	90	92½
Cities Service	7sB 1966	f177½	....	....
Cities Service	7sC 1966	126½	111	128
Cities Service	7sD 1966	101½	98½	106½
Cities Service	7s E 1966	f109½	....	....
Cities Service Pwr. & Lt.	6s 1944	94½	92	95½
City Lt. & Trac., Sedalia, Mo.	5s 1952	k 84	74	85½
Cleveland Elec. Illum.	5s 1939	k102	100	102½
Cleveland Elec. Illum.	5s 1954	k100½	97½	101
Cleveland Elec. Illum.	7s 1941	k110	109	111½
Colorado Pwr.	5s 1953	f 95	....	....
Columbia Gas & Elec.	5s 1927	100½	100	102½
Columbia Ry., Gas & El.	5s 1936	k 92½	92½	94½
Columbus, Dela. & Marion Elec.	5s 1937	k 85	83	88
Columbus, Dela. & Marion Elec.	6s 1937	k 94	91	98
Columbus Elec. & Pwr.	6s 1947	f102	....	....
Columbus Ry., Pwr. & Lt.	5s 1940	k 95½	93½	98
Columbus Ry., Pwr. & Lt.	6s 1941	k104½	101½	105½
Commonwealth Edison.	5s 1943	k102	99½	102½
Commonwealth Edison.	5s 1953	k 99½	98½	101
Commonwealth Edison.	5s 1954	k 99½	98	101
Commonwealth Pwr.	6s 1947	103	97½	103½
Community Pwr. & Lt.	6s 1950	k 98	94½	98
Conn. Ry. & Ltg.	4½s 1951	91	90½	92½
Consol. Cities, Lt., Pwr. & Trac.	5s 1962	k 80½	75½	82½
Consol. Elec.	5s 1955	k 97½	94	98½
Consol. Gas of N. Y.	5½s 1945	104½	101½	105
Con. Gas, Elec. Lt. & Pwr. of Balti.	4½s 1935	k 97½	93½	97½
Con. Gas, Elec. Lt. & Pwr. of Balti. (notes)	6s 1949	c106½	104½	106½
Con. Gas, Elec. Lt. & Pwr. of Balti. notes	5½s 1952	k104½	102½	105½
Con. Gas, Elec. Lt. & Pwr. of Balti.	5s 1965	c100½	98	100½
Consumers Elec. Lt. & Pwr.	5s 1936	k 95	93	96½
Consumers Pwr.	5s 1936	k100½	99	100½
Consumers Pwr.	5s 1952	97½	90½	100
Consumers Pwr.	5½s 1954	k103	99	104½
Continental Gas & Elec.	5s 1927	f100	....	....
Continental Gas & Elec.	6s 1947	f 99½	....	....
Continental Gas & Elec.	6½s 1964	f 98½	96½	101
Continental Gas & Elec.	7s 1954	f104½	....	....
Cumberland County Pwr. & Lt.	5s 1942	k 95	92	96½
Dallas Pwr. & Lt.	6s 1949	k104	103	105½
Dayton Ltg.	5s 1937	k100	98½	100½
Dayton Pwr. & Lt.	5s 1941	k 99½	97	100½
Defiance Gas & Elec.	5s 1942	k 97	88½	97½
Denver Gas & Elec.	5s 1949	k 98	97½	100
Denver Gas & Elec. Lt.	5s 1951	93½	92½	97
Des Moines Elec.	5s 1938	k 99	98	100½
Detroit Edison.	5s 1933	100½	99½	102½
Detroit Edison.	5s 1940	102½	99½	102½
Detroit Edison.	5s 1949	101½	97½	101½
Detroit Edison.	5s 1955	99½	99½	100½
Detroit Edison.	6s 1932	k139	110½	155
Detroit Edison.	6s 1940	107½	106½	108½
Detroit Edison.	7s 1928	k136½	125	156½
Detroit Edison.	7s 1929	k138½	114	150½
Detroit Edison.	7s 1930	k132½	121½	158½
Dominion Pwr. & Trans.	5s 1932	k 96½	95½	98½
Driver-Harris.	8s 1931	k 95	88	97
Dubuque Elec.	6s 1942	k101½	97½	102
Duke-Price Pwr.	6s 1949	k102	98½	103
Duquesne Lt.	6s 1949	105½	104½	107½
Duquesne Lt.	5½s 1949	104½	104	106
Durham Pub. Serv.	7s 1949	k100	97½	101½
East Penn. Elec.	6s 1953	k104½	100½	105½
East Oregon Lt. & Pwr.	6s 1929	k100	97½	100½
East. Tex. Elec.	5s 1942	f 95	....	....
Economy Lt. & Pwr.	5s 1956	k 98½	96	99½
Edison Elec. Illum. of Bkln.	4s 1939	92	89	95½
Edison Elec. Illum. (N. Y.)	5s 1995	102½	99½	103
El Paso Elec.	5s 1932	f102	....	....
El Paso Elec.	5s 1950	f 95½	....	....
Elec. Pwr. Corp. (Germany)	6½s 1950	86½	86½	88½
Elmira Wtr., Lt. & R.R.	5s 1956	k 95	92½	96½
Empire Dist. Elec.	5s 1949	k 91½	86½	91½
Erie Ltg.	5s 1967	k 98	95½	99½
Evansville Gas & Elec. Lt.	5s 1932	k 98½	96	100
Federal Lt. & Trac.	5s 1942	92½	88	96½
Federal Lt. & Trac.	6s 1942	101	96½	103
Federal Lt. & Trac.	6s 1954	93	91½	94½
Ft. Smith Lt. & Trac.	5s 1936	78	76½	82½
Ft. Worth Pwr. & Lt.	5s 1931	k 99½	99	100½
Galveston Elec.	5s 1940	k 90	86½	93½
General Elec.	3½s 1942	88½	83	90½
Georgia Carolina Pwr.	5s 1952	k 86	82	90
Ga. Lt., Pwr. & Rys.	5s 1941	k 86½	86½	90½
Ga. Ry. & Elec.	5s 1932	k 99	98½	100½
Ga. Ry. & Elec.	5s 1949	k 92½	88	94½
Ga. Ry. & Pwr.	5s 1954	k 94½	89½	96
Ga. Ry. & Pwr.	6s 1947	k102½	100½	103½
Ga. Ry. & Pwr.	7s 1941	k104½	105	107
German Gen. Elec.	7s 1945	95	92	96½
German Gen. Elec.	6½s 1940	k 94½	94	94½
Great Cons. Elec. Pwr. (Japan)	6½ 1950	85½	85½	86½
Great Cons. Elec. Pwr. (Japan)	7s 1944	91½	87½	92
Great Falls Pwr.	5s 1940	k101½	99½	103½
Great Northern Pwr.	5s 1935	k 98½	96	99
Great Western Pwr.	5s 1946	k 99	95	99½
Great Western Pwr.	5½s 1955	k 98½	96	99½
Great Western Pwr.	6s 1949	k101½	100	102½
Great Western Pwr.	6s 1952	k101½	99½	102½
Hamburg Elec.	7s 1935	k 96	95½	96
Havana Elec. Ry., Lt. & Pwr.	5s 1954	92½	85½	95½
Holtwood Pwr.	6s 1954	k103½	100	104½
Houston Ltg. & Pwr.	5s 1931	90½	98½	100
Houston Ltg. & Pwr.	5s 1953	k 94	90½	95½
Houston Ltg. & Pwr.	5½s 1954	k101½	97	102½
Hydraulic Pwr.	5s 1951	k101	99½	102
Hydraulic Pwr.	5s 1950	k101	100	103
Idaho Pwr.	5s 1947	k 96½	93	97½
Ill. Elec. Pwr.	6s 1943	k102½	99½	103½
Ill. Pwr.	5s 1933	k 93½	93	95½
Ill. Pwr. & Lt.	6s 1953	k101½	100½	102½
Ill. Pwr. & Lt.	7s 1953	k102½	99	102½
Ind. Elec.	6s 1947	k 98	97	99½
Ind. Gen. Serv.	5s 1948	k 95½	93	97½
Ind. Lighting	4s 1958	k 82	78	83
Indiana & Mich. Elec.	5s 1957	k 98	97½	99½
Indiana & Mich. Elec.	5s 1955	k 95½	95	98
Ind. Pwr.	7½s 1941	k105½	104	106

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco. dBid, low, high, Monday, Dec. 28. jBid, low, high, Tuesday, Dec. 29. kLatest quotations available.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies		Bid Price Thursday, Dec. 24	Low 1925	High 1925
BONDS (Continued)				
Ind. Service	5s 1950	k 89	86½	92
Ind. Service	6s 2020	k 84½	73	88½
Ingersoll-Rand	5s 1935	99½	99½	99½
Interstate Elec	6s 1933	k 95	95	99½
Interstate Pwr	6s 1944	f 99	....	....
Interstate Pwr	7s 1934	f100	....	....
Interstate Pub. Serv	6s 1948	k 98½	96	100½
Iowa Ry. & Lt.	5s 1932	k 98½	97	99½
Italian Power	6½s 1928	k 99½	97½	100
Jersey Cent. Pwr. & Lt.	5½s 1945	k95½	95	98
Kansas City Pwr. & Lt.	5s 1952	100½	95½	102
Kansas Elec. Pwr.	6s 1937	k 00½	97½	102
Kansas Elec. Pwr.	6s 1943	k 00½	97½	102
Kansas Gas & Elec.	6s 1952	101½	98½	103½
Kansas Gas & Elec.	6s 2022	k 91½	86½	94½
Kentucky Utilities	6s 1949	k100½	97	101½
Kings County Elec. Lt. & Pwr.	5s 1937	102	99	103
Kings County Elec. Lt. & Pwr.	6s 1997	120½	114½	120½
Kings County Ltg.	5s 1954	98½	89	101½
Kings County Ltg.	6½s 1954	107½	103½	108½
Knoxville Ry. & Lt.	5s 1946	k 94	88	95½
Laclede Gas Lt.	5s 1934	101	98½	101½
Laclede Gas Lt.	5½s 1953	102½	95½	102½
Laurentian Pwr.	6s 1936	k 99	96	100½
Laurentide Pwr.	6s 1936	k 99	96	100
Laurentide Pwr.	5s 1946	k 99	97	100½
Lehigh Pwr. Sec. (notes)	6s 1927	101	....	....
Lincoln Gas & Elec.	5s 1941	k 91	92½	95½
Long Island Ltg.	5s 1936	k 99½	98½	100½
Long Island Ltg.	6s 1954	k100½	99½	102
Long Island Ltg.	6s 1948	k105	102	105½
Los Angeles Gas & Elec.	5s 1939	k100	98	101½
Los Angeles Gas & Elec.	5½s 1943	k 98½	94	99½
Los Angeles Gas & Elec.	5½s 1947	k 98½	96	99
Los Angeles Gas & Elec.	5½s 1949	k 98	95½	99½
Los Angeles Gas & Elec.	4½ 1942	f102½	101½	104½
Louisiana Pwr.	6s 1944	98	....	....
Louisville Gas & Elec.	5s 1952	97½	90½	99½
Louisville Gas & Elec.	5½s 1954	k102½	99	103
Lower Austrian Hydro Elec.	6½s 1944	86½	85½	87
Luzerne County Gas & Elec.	5s 1948	k 98	97	99½
Luzerne County Gas & Elec.	7s 1944	k104½	99½	104½
Luzerne County Gas & Elec.	6s 1954	k102½	99	105
Madison River Pwr.	5s 1935	k100½	99½	101
Manila Elec.	7s 1942	164	97½	103
Manila Elec. Ry. & Ltg.	5s 1953	89½	85	92
Manitoba Pwr.	7s 1941	103½	98½	104½
Memphis Pwr. & Lt.	5s 1948	k 99	95	99½
Metropolitan Edison	6s 1952	104½	101½	106½
Metropolitan Edison	5s 1953	97½	91½	97½
Metropolitan Pwr.	6s 1953	102½	100	104
Michigan Lt.	5s 1946	k 99½	97½	100
Michigan No. Pwr.	5s 1941	k 97½	95½	98
Milwaukee Elec. Ry & Lt.	5s 1926	99½	99½	101½
Milwaukee Elec. Ry. & Lt.	4½s 1931	97	94½	97½
Milwaukee Elec. Ry. & Lt.	5s 1951	98½	94	100
Milwaukee Elec. Ry. & Lt.	5s 1961	90	84½	92½
Milwaukee Elec. Ry. & Lt.	6s 1953	100½	98½	104
Minn. Pwr. & Lt.	5s 1955	k 96	95	97
Minn. Pwr. & Lt.	6s 1950	k103½	101½	105½
Miss. River Pwr.	5s 1951	99½	....	....
Miss. River Pwr.	7s 1935	102	....	....
Mo. Edison Elec.	5s 1927	k 99½	99½	100½
Mobile Elec.	5s 1946	k 97	91	97½
Montana Pwr.	5s 1943	100	97½	100½
Montgomery Lt. & Wtr. Pwr.	5s 1943	k 93	86½	93½
Montreal Lt., Ht. & Pwr.	4½s 1932	k 97½	97	98½
Montreal Lt., Ht. & Pwr.	5s 1933	k 99	98½	101
Montreal Pub. Serv.	5s 1942	k 94½	89	94½
Mountain States Pwr.	6s 1938	k 98½	96½	100½
Nashville Ry. & Lt.	5s 1953	k 97½	94	98
Nashville Ry. & Lt.	5s 1958	k 90½	84	92
Nassau Lt. & Pwr.	5s 1927	k 90	98	101
Nassau & Suffolk Ltg.	5s 1945	k 90	82	91
National Pwr. & Lt.	7s 1972	k103½	....	....
National Pub. Serv.	6½s 1955	k 94½	94	96½
Nebraska Pwr.	5s 1949	k 99½	97	100½
Nebraska Pwr.	6s 2022	k 94½	89½	97½
Nevada-Calif. Elec.	6s 1946	k 98	96½	100½
Nevada-Calif. Elec.	6s 1950	k 98	96½	100½
New England Pwr.	5s 1951	k101½	100½	103
New Jersey Pwr. & Lt.	5s 1936	k 96½	92½	97½
New Orleans Pub. Serv.	4½s 1935	k 86½	83½	88½
New Orleans Pub. Serv.	5s 1952	90½	89½	92
New Orleans Pub. Serv.	5s 1955	91	88½	92½
New Orleans Pub. Serv.	6s 1949	k 90	86½	93½
N. Y. & Queens Elec. Lt. & Pwr.	5s 1930	99½	99½	101
N. Y. & Westchester Ltg.	4s 2004	k 79	76	81
N. Y. & Westchester Ltg.	5s 1954	k 97	93	97½
New York Edison	6½s 1941	115½	112	115½
New York Edison	5s 1944	101½	99½	102
N. Y. Gas & Elec. Lt. Ht. & Pwr.	5s 1948	103½	100½	104½
N. Y. Gas & Elec. Lt. Ht. & Pwr.	4s 1949	89½	86	90½
N. Y. State Gas & Elec.	5½s 1962	k 100½	96	101½
Newport News & Hampton Ry. Gas & Elec.	5s 1944	f 87	....	....
Niagara Falls Pwr.	5s 1932	101½	99½	103
Niagara Falls Pwr.	6s 1932	105½	103	106½
Niagara Falls Pwr.	6s 1950	k105½	105½	106½
Niagara, Lock. & Ont. Pwr.	5s 1954	k 98½	104½	110
Niagara, Lock. & Ont. Pwr.	5s 1955	99½	97½	100
Niagara, Lock. & Ont. Pwr.	6s 1958	k109½	104½	110½
Norfolk Ry. & Lt.	5s 1949	k 94	93	95½
No. Amer. Edison	6s 1952	101½	96½	103
No. Amer. Edison	6½s 1948	k103½	100½	106
No. Amer. Lt. & Pwr.	7s 1954	k 99½	97	100½
North Caro. Pub. Serv.	5s 1934	f 90½	....	....
North Caro. Pub. Serv.	6s 1954	k 93	91½	96
North Caro. Pub. Serv.	6½s 1944	k 99	96	100
North Shore Elec.	5s 1940	k 99½	97½	100
No. Calif. Pwr.	5s 1948	k 99½	98½	100½
No. Ind. Gas & Elec.	5s 1929	k 98½	97	100½
No. Ind. Gas & Elec.	6s 1952	k102½	99½	103
Northern N. Y. Utilities	5½s 1949	k100	96½	100
No. Ohio Trac. & Lt.	4s 1933	k 87	82	87½
No. Ohio Trac. & Lt.	5s 1956	k 83	78	87
No. Ohio Trac. & Lt.	6s 1926	k 99	98½	100
No. Ohio Trac. & Lt.	6s 1947	93	91	97
No. Ontario Lt. & Pwr.	6s 1931	k 99½	95½	99½
No. States Pwr.	6½s 1933	128	105½	141
No. States Pwr. (notes)	6½s 1933	103	99½	104½
No. States Pwr.	6s 1948	k103	101	104½
No. States Pwr.	6s 1941	105½	103	107½
No. States Pwr.	5s 1941	98½	93	99½
No. Tex. Elec.	5s 1940	f 75	....	....
Northwestern Elec.	6s 1935	k101½	101½	102½
Northwestern Pub. Serv.	6½s 1948	k 99	97½	100½
Ohio Pwr.	5s 1952	k 94½	89	96½
Ohio Pwr.	6s 1953	k103½	101	104½
Ohio Pwr.	6s 2024	k 95	88½	95½
Ohio Pwr.	7s 1951	k105½	105½	107½
Ohio Pub. Serv.	5s 1954	k 91½	87	93
Ohio Pub. Serv.	6s 1953	k100½	99	101½
Ohio Pub. Serv.	7½s 1946	112½	108	112½
Ohio Pub. Serv.	7s 1947	110½	107½	111½
Ohio River Edison	6s 1948	101½	98½	104
Okla. Gas & Elec.	5s 1950	k 92½	91½	95
Okla. Gas & Elec.	6s 1940	k 96½	95½	98½
Ontario Pwr. of Niagara Falls	5s 1943	99½	98	100½
Ontario Transmission	5s 1945	99½	97	99½
Ozark Pwr. & Wtr.	5s 1952	k 76	75	79
Pacific Coast Pwr.	5s 1940	k 99	98	100
Pacific Gas & Elec.	5s 1942	97½	93½	99
Pacific Gas & Elec.	5s 1955	k 93½	94	95½
Pacific Gas & Elec.	5½s 1952	k101	99½	102½
Pacific Gas & Elec.	6s 1941	k106	103½	106½
Pacific Lt. & Pwr.	5s 1951	k 99½	98½	100½
Pacific Lt. & Pwr.	5s 1942	k 99½	98	101½
Pacific Pwr. & Lt.	5s 1930	99½	98	100
Pacific Pwr. & Lt.	5s 1953	k 96½	....	....
Parr Shoals Pwr.	5s 1952	k 93	92½	97
Paterson & Passaic Gas & Elec.	5s 1949	100	96	100½
Penn Central Lt. & Pwr	6s 1953	k103½	102	104½
Penn Edison	5s 1946	k 96½	93½	97½
Penn Elec.	6½s 1954	k 97½	96	99½
Penn. Elec.	6s 1955	k 92½	91½	95
Penn.-Ohio Edison	6s 1950	k 97½	96½	98½
Penn Ohio Elec.	6½s 1938	k105	99½	105½
Penn Ohio Pwr. & Lt.	5½s 1954	k 97½	95	99½
Penn Ohio Pwr. & Lt.	6s 1939	k 97½	94	99½
Penn Pwr. & Lt.	5s 1952	97½	95	98
Penn Pwr. & Lt.	5s 1953	k 97½	95	98
Penn Pwr. & Lt.	6s 1953	k104½	102½	105½
Penn Pwr. & Lt.	7s 1951	k105½	105½	107
Penn Pub. Serv.	5s 1954	k 95½	93	96
Penn Pub. Serv.	6s 1947	k104	103	105½
Penn Wtr. & Pwr.	5s 1940	k101½	99½	102½
Penn Wtr. & Pwr.	5½s 1953	k102½	100	103
Phila. Co.	6s 1944	103½	101½	105
Phila. Co.	5½s 1938	99	93½	100
Phila. Co.	5s 1951	c 96½	93½	98½
Phila. Co.	5s 1949	k102½	94½	104
Phila. Elec.	6s 1941	c108	106	108½
Phila. Elec.	5s 1966	c103	100	104½
Phila Elec.	4s 1966	c 85½	83	85
Phila. Elec.	5s 1960	c101½	100	104
Phila. Elec.	5½s 1947	c106½	103½	107
Phila. Elec.	5½s 1953	c106½	104½	107½
Portland Elec. Pwr.	6s 1947	99	96½	100½
Portland Gen. Elec.	5s 1935	99½	98½	100½
Portland Ry., Lt. & Pwr.	5s 1942	88½	84½	92
Portland Ry., Lt. & Pwr.	6s 1947	99½	94	100½
Portland Ry., Lt. & Pwr.	7½s 1946	106	104½	108
Potomac Edison	6s 1949	k 98½	96	100
Potomac Edison	6½s 1948	k102½	99	103½
Potomac Elec. Pwr.	5s 1929	k 99½	99	100½
Potomac Elec. Pwr.	5s 1936	k 99½	98½	100
Power Corp. of N. Y.	6s 1942	k100½	97	101½
Power Corp. of N. Y.	6½s 1942	k104½	101½	105½
Power Securities	6s 1949	88	....	....
Pub. Lt. & Pwr.	5s 1945	b 69	64	79
Pub. Serv. Co. of Colo.	5½s 1954	k 93½	92	96
Pub. Serv. Co. of Colo.	6s 1953	k 98½	98	101
Pub. Serv. Co. of Colo.	7s 1933	k101	98½	102½
Pub. Serv. Corp. of N. J.	5s 1959	104½	103½	105½
Pub. Serv. Corp. of N. J.	6s 1944	99½	95	101
Pub. Serv. Co. of No. Ill.	5s 1956	k 97½	91	97½
Pub. Serv. Co. of No. Ill.	5½s 1962	k101½	96½	102½
Pub. Serv. Co. of No. Ill.	5½s 1964	k101½	96½	102½
Pub. Serv. Co. of Okla.	6s 1949	k 99	97½	101
Pub. Serv. Elec. & Gas.	5½s 1959	103½	98½	105½
Pub. Serv. Elec. & Gas.	5½s 1964	104½	99½	105
Public Utilities (Evansville, Ind.)	6s 1929	k100	99	101
Puget Sound Pwr.	5s 1933	k 98½	98½	100½
Puget Sound Pwr. & Lt.	5½s 1949	99	....	....
Quebec Pwr.	6s 1953	k102	98½	102½
Queensborough Gas & Elec.	5s 1952	k 99	96½	100½
Queensborough Gas & Elec.	6s 1953	k104½	101	105½
Rhine-Westphalia Electric Power	7s 1950	94	94	95
Rio de Janeiro Tram., Lt. & Pwr.	5s 1935	k 93	85	93½
Robbins & Myers	7s 1952	61½	57½	73½
Rochester Gas & Elec.	5½s 1948	105½	102½	105½
Rochester Gas & Elec.	7s 1946	112½	110	112½
Rochester Ry. & Lt.	5s 1954	k100	99	101
Rockford Elec.	5s 1939	k 99½	98	101
St. Joseph Ry., Lt., Ht. & Pwr.	5s 1937	85½	85½	93
St. Paul Gas Lt.	5s 1944	k100½	98½	101½
St. Paul Gas Lt.	5½s 1954	k101½	98	102½
Salt River Valley Wtr.	6s 1938	f100	....	....
Salmon River Pwr.	5s 1952	k100½	98½	101½
San Antonio Gas & Elec.	5s 1949	k 96½	96	98½
San Antonio Pub. Serv.	6s 1952	101½	99½	104
San Diego Cons. Gas & Elec.	5s 1939	k100	98	10[illegible]
San Diego Cons. Gas & Elec.	6s 1939	k101½	99	103
San Joaquin Lt. & Pwr.	5s 1945	k 98½	98	100
San Joaquin Lt. & Pwr.	6s 1950	k102	101	103½
San Joaquin Lt. & Pwr.	6s 1952	k101	99½	103½
San Joaquin Lt. & Pwr.	6s 1954	k100½	99	101
Sauda Falls	5s 1955	96	95½	98½
Savannah Elec. & Pwr.	7½s 1941	f104½	....	....
Saxon Pub. Wks. (Germany)	7s 1945	92	90½	94½
Scranton Electric	5s 1937	k101½	99½	101½
Seattle Elec.	1930	f100	....	....
Seattle Elec.	5s 1929	f 99½	....	....
Seattle Elec.	5s 1939	k 92	90	93½
Seattle Ltg.	5s 1949	k 92	85½	93
Shawinigan Wtr. & Pwr.	5s 1934	k100	100	101½
Shawinigan Wtr. & Pwr.	5½s 1950	k103½	101½	104
Shawinigan Wtr. & Pwr.	6s 1950	k105	104	106½
Siemens & Halske	7s 1928	96	92½	99½
Siemens & Halske	7s 1935	94½	90½	96½
Sierra & San Francisco Pwr.	5s 1949	91½	90	95½
Sierra & San Francisco Pwr.	6s 1949	k 90	90	95½
Sioux City Gas & Elec.	6s 1947	k101½	99	102
Sioux City Gas & Elec.	6s 1949	k101½	99	102
So. Caro. Gas & Elec.	6s 1942	k 84	87	93
So. Caro. Gas & Elec.	6s 1932	k 75	78	88
Southeast Pwr. & Lt.	6s 2025	100½	95½	100½
So. Cal. Edison	5s 1939	k 99½	99½	101
So. Cal. Edison	5s 1944	96½	92	97½
So. Cal. Edison	5½s 1944	k101	98½	102
So. Cal. Edison	6s 1943	k102½	100½	104
So. Cal. Edison	6s 1944	k104½	102½	105½
So. Cities Utilities	8s 1931	k 98	99	102
Southern Colo. Power	6s 1947	97½	93½	99½
So. Public Utilities	5s 1943	k 99½	97½	100½
So. Sierras Pwr.	6s 1936	k102½	102	104½
So. Utilities	6s 1933	k102	97½	102½
So. Wisconsin Pwr.	5s 1938	k 90½	88	93
Southwestern Gas & Elec.	5s 1932	k 96½	94	98
Southwestern Gas & Elec.	6s 1957	k 97	89	98
Southwestern Lt. & Pwr.	6s 1937	k 97½	94½	97½
Southwestern Pwr. & Lt.	5s 1943	k 94	90	97
Southwestern Pwr. & Lt.	6s 2022	k 93½	88½	94½
Southwestern Utilities	8s 1936	k 96	96	102
Springfield Ry. & Lt.	5s 1926	k 99½	98½	100½
Standard Elec. of Cal.	5s 1939	k 98½	98½	100½
Standard Gas & Elec.	6s 1935	f 99	....	....
Staten Island Edison	6½s 1953	k105	104	106½
Syracuse Ltg.	5s 1951	100½	97½	101½
Syracuse Ltg.	5½s 1954	k102	100½	103½
Tampa Elec.	5s 1933	f 99	....	....
Tenn. Elec. Pwr.	6s 1947	02½	99½	104½
Tenn. Pwr.	5s 1962	k 94½	90	96½
Tex. Pwr. & Lt.	5s 1937	k 98	97	99½
Tex. Pwr. & Lt.	6s 2022	k 94½	90	97½
Tide Water Pwr.	6s 1942	k 99½	98½	101
Tide Water Pwr.	7s 1937	k 99½	97½	101½
Toho Elec. Pwr. (Japan)	7s 1955	90½	87	91½
Tokyo Elec. (Japan)	6s 1928	97	96½	99½
Toledo Edison	5s 1947	k 98½	97	100
Toledo Edison	7s 1941	108½	108½	110
Toledo Gas Elec. & Htg.	5s 1935	k 96½	97½	100½
Toledo Trac., Lt. & Pr. notes	5½s 1930	98½	97½	100½
Topeka Edison	5s 1930	k 98½	97	100
Topeka Ry. & Lt.	5s 1933	k 95	90½	96½
Trenton Gas & Elec.	5s 1949	99½	98	100
Tri-City Ry. & Lt.	5s 1930	k 98½	96½	99½
Twin State Gas & Elec.	5s 1953	k 92½	84	94½
Tyrol Hydro-Elec. Pwr.	7½s 1955	96½	94½	97
Union Elec. Lt. & Pwr.	5s 1932	100½	99½	102
Union Elec. Lt. & Pwr.	5s 1933	100½	98½	101
Union Elec. Lt. & Pwr.	5s 1954	k99	97½	100
Union Elec. Lt. & Pwr.	5½s 1954	101	100	104
United Elec. of N. J.	4s 1949	k 87½	85	88½
United Elec. Lt. & Pwr.	4½s 1929	k 98½	98½	99
United Gas & Elec.	6s 1945	k 97½	96	101
United Lt. & Pwr. notes	5½s 1928	k 99½	98	100
United Lt. & Pwr.	5½s 1959	k 94½	90½	97½
United Lt. & Pwr.	6½s 1974	k 96	92½	97½
United Lt. & Rys.	5s 1932	k 95½	92½	97½
United Lt. & Rys.	6s 1926	k 99½	100½	101½
United Lt. & Rys.	6s 1952	k 98½	95½	100½
United Lt. & Rys.	6s 1973	k 89½	87	92
United Pwr. & Lt.	6s 1944	k101½	99	103
Utah Lt. & Trac.	5s 1944	87½	83½	91½
Utah Pwr. & Lt.	5s 1944	95½	91	98½
Utah Pwr. & Lt.	6s 1944	k102½	102	104½
Utah Pwr. & Lt.	6s 2022	k 93	88½	94½
Utica Elec. Lt. & Pwr.	5s 1950	101½	100½	102½
Utica Gas & Elec.	5s 1957	100	98½	103
Vermont Hydro-Elec.	6s 1929	k100	98½	100½
Vicksburg Lt. & Trac.	5s 1932	k 91	89	93½
Virginian Pwr.	5s 1942	k 92½	88	96
Virginian Pwr.	6½s 1954	k103	99	103
Virginia Ry. & Pwr.	5s 1943	98½	93½	99
Wagner Elec. Mfg.	7s	k101½	100	102
Washington Coast Util.	6s 1941	f102	....	....
Washington Wtr. Pwr.	5s 1939	101½	99½	101½
West Penn Pwr.	5s 1963	100	93½	100
West Penn Pwr.	5s 1946	99½	93½	100½
West Penn Pwr.	5½s 1953	104½	100½	105½
West Penn Pwr.	7s 1946	106	104½	107½
West Virginia Lt., Ht. & Pwr.	6s 1929	k100½	95	101
West Virginia Utilities	6s 1935	k 95½	91	98
Westchester Ltg.	5s 1950	102½	98	102
Western Elec.	5s 1944	100½	98	101½
Western N. Y. Utilities	5s 1946	k96½	90½	97½
Western Pwr.	6½s 1954	k100½	97	101
West. States Gas & Elec.	5s 1941	f 97½	....	....
West. States Gas & Elec.	6s 1947	f 99	....	....
Westinghouse Elec. & Mfg.	7s 1931	106	105½	108½
Westphalia Un. Elec. Pr.	6½s 1950	k 87½	87½	87½
Wisconsin Elec. Pwr.	5s 1954	k 98½	93½	99½
Wisconsin Gas & Elec.	5s 1952	k 99	97	100½
Wis.-Minn. Lt. & Pwr.	5s 1944	k 95½	93	96½
Wis. Ry., Lt. & Pwr.	5s 1933	k 92½	87½	93½
Wis. River Pwr.	5s 1941	k 91½	88	92½
Yadkin River Pwr.	5s 1941	k 98½	96½	99½
Yarmouth Lt. & Pwr.	5s 1937	k 83	82	87
Yarmouth Lt. & Pwr.	8s 1951	k 98	97	102

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco. dBid, low, high, Monday, Dec. 28. fBid, low, high, Tuesday, Dec. 29. kLatest quotations available.

Manufacturing and Markets

Collection of Statistics a Means of Development

Duty of Trade Associations to Develop Present Opportunity—Efforts Will be Judged by Results

By Alfred E. Waller
President Electric Power Club

AN UNUSUAL opportunity for sound and intelligent development is now open to the electrical industry through the collection and dissemination of vital statistics. The recent Supreme Court decisions relating to organized activities of this kind have attracted wide

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attention. They clearly define the scope of permissible statistical activities and put business on probation, giving it an opportunity to show that certain kinds of organized action are necessary and desirable for the public.

The situation in a few words is this: Prior to 1890 there were a number of business combinations and organized operations which were popularly considered to have been oppressive and in restraint of trade. The Sherman law was enacted in an attempt to end the restrictive combinations. This act was framed in response to popular demand and was made so broad that all business combinations and organized efforts were covered and forbidden. No allowance was made for the fact that many combinations are actually desirable and necessary for the public welfare.

After years of experimenting and experience, during which time trade associations discontinued many of their useful and normal functions, fearing that these might be considered restrictive, the public has come to realize that many of the activities of organized business are necessary and desirable. Certain functions of trade associations are now approved. Their possibilities are being actively investigated by associations in many branches of industry. When the permissible activities are fully developed and in operation they will be of immense value and will stabilize and benefit business to an extent little appreciated at present.

It is necessary to realize that this great opportunity carries with it an equally great responsibility, that of continual and conscientious adherence to the limitations which the court has imposed. The old order of complete restraint has been tried and found wanting. A certain amount of freedom of action has been granted to business as an experiment. The manner in which this is used will decide whether greater or less freedom will be permitted in the future. Every business organization and every trade association must realize this fact. It is only reasonable to believe that the morals and the intelligence of business today are such that the fair and open collection and distribution of vital statistics is possible and practicable. A review of the relations between business and the public for the past fifty years shows clearly that selfish and restrictive action on the part of business has been followed by reprisals. No temporary advantage which might be gained by restrictive action can possibly offset the damage which would result from such a program. It is the duty of trade associations to develop the opportunities now open to the utmost, always remembering that their efforts will be judged by the results achieved.

Standardization Requires Co-operative Effort

Production Based on Simplification and Standardization—Movement Involves All Industry

By C. E. Skinner
Assistant Director of Engineering, Westinghouse Electric & Manufacturing Company

NOWHERE in the world is there such opportunity for the marketing of materials and commodities in quantity as in the United States. Nowhere in the world are the prices of labor for producing these materials and commodities so high. With high wages production of any device at a reasonable price is impossible except on the basis of standardization. In order to achieve greater production at a price which will compete with the markets of the world and retain our present wage level we must resort to simplification and standardization. This includes grading and standardization of quality of materials, standardization of dimensions, the use of standard processes, standard tools and shop methods. The use of standard screws, standard sizes of wire, standard grades of steel and other materials is no bar whatever to individuality in design or the obtaining of superior performance. Any large manufacturing organization would be justified in giving prizes to that engineer who would produce the maximum of new and useful devices with a minimum use of new and special material.

In order to achieve standardization in our manufactured products co-operative effort of every agency involved from the producer of the basic raw material to the final user of the product is essential. It should be remembered that the finished product of each group in this series is the raw material of the next in order. The manufacturers of copper wire must have standard grades of copper bar from the smelter. The insulating department must have wire of standard size and standard conductivities. The electric manufacturer must have insulated wire of standard

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conductivity, standard insulation and standard dimensions. The user of the motor needs standard shaft dimensions, standard performance, and for the proper operation of his motor he requires from the power company standard frequency, standard voltages and standard methods of measurement of the current. If the motor is applied to a machine tool, there must be co-operation between the motor manufacturer and the tool manufacturer. The user of the tool works best if the various arrangements for the control of the motor are in line with the standard with which he is familiar. To make the most advantageous use of the combined motor and tool it should work on standard parts requiring the minimum of set-ups in order to secure maximum output. This illustration could be carried on more or less indefinitely.

Standardization, beginning in individual factories to achieve quantity production of some particular article, has grown to be a great national movement involving every branch of industry. The intensive safety program so necessary to mitigate the hazards created by our industrial life is a most essential part of this program of standardization. The carrying out of these programs will result in making possible more conveniences, comforts and even luxuries to the masses of our people than ever before, and through our standardiza-

tion of safety measures we should achieve reasonable safety in all our industrial processes, and even in that greatest of present-day hazards, our street and highway traffic.

Manufacturers' Problem One of Proper Management

Opportunity to Render a Better Service —Prosperity Will Depend on Results Achieved

BY GERARD SWOPE
President General Electric Company

THE electrical industry has before it today the opportunity of rendering a better service to society than ever before. A heavy responsibility rests with the manufacturer in properly performing his part of this service. The electrical industry can be of assistance in the solution of some of the problems of both agriculture and transportation, and one of the first things that the industry can do is to put the waste forces of water power to work. Industry has largely passed through its trial by fire. This very fact may lead to a too complacent attitude bringing with it other problems. A clearer and more reasonable interpretation of the law as to what trade associations may do has brought with it the danger that some industries may want to go beyond these interpretations.

The problem of the manufacturer today is management, not only as relates to the planning of work for the workmen in the factory and to correct relations between the workmen and the organization as a whole, but also as concerning the responsibility for the correct interpretation and the proper

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relations of the organization as a whole to the public. If an organization is properly managed, it will furnish what the community wants of good quality and at a fair price, and it will always be rewarded for that service by an adequate profit. We know of no better way than this to bring forth the best effort of individuals or of organizations today, and though there may be faults in the capitalistic system, it seems much better to use it as a basis and to improve upon it than to turn to untried experiments in the complex machinery civilization has built up. Industry prosperity will depend upon results achieved by proper management.

Good Business in 1926

Continued Prosperity for Immediate Future—Industrial Sales Active— Utility Plans Encouraging

BY E. M. HERR
President Westinghouse Electric & Manufacturing Company

THE question "How's business?" always an interesting one, is especially pertinent as we approach the beginning of a new year. Notwithstanding the very great activity in the stock market and the large volume of business during the last quarter of the present year, fundamental conditions affecting business are extremely good and money is plentiful. Agricultural crops have been satisfactory, and the iron and steel industry, as well as the building trades, has shown increased activity. This will surely cause business in general to be good at least during the first quarter of the new year. In addition to these favorable indications, the railroads are more prosperous than they have been for a long time, and this situation is reflected in increased buying and larger expenditures for maintenance and improvements.

All of these activities bring business to the electrical manufacturers, largely in their industrial and domestic supply departments; but, in addition, the great public utility companies are rapidly absorbing the additions to their facilities which were installed during the preceding two years and are planning for a notable increased capacity, which will bring a good volume of business to the power and light departments of the manufacturers.

We can, therefore, confidently look forward to the first quarter of the new year as one of continued good business, with at least an upward trend. How business will continue during the remainder of the year is, of course, uncertain and will depend on many conditions not yet possible of determination. Favorable progress in the settlement of the European debts and the consequent stabilization of their cur-

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rencies, coupled with good crops in our own country, will help very greatly in a continuation of good business throughout the coming year, which all indications seem to assure during the immediate future. The reduction in federal taxes now being considered by Congress will also encourage constructive development by industry along all lines.

Business Conditions

STEADY buying continues to be reported by the electrical industry. The close of the year has found electrical men very optimistic as to the trend during the early part of next year—this optimism being based on the present good volume of business and on the inquiries either in the market or definitely reported as on the way. Industrial-plant buying has made up the bulk of the business, although central-station companies have been purchasing supplies steadily and are expected to buy a good amount of generating equipment this year.

There are no spectacular orders, but aggregate business is large, one order covering $300,000 worth of underground cable and distribution equipment, another about the same amount for transformers, and another electric equipment for gas-electric buses amounting to about $325,000. The activity in Florida has resulted in many inquiries from holding companies operating in that territory.

In New England the trend of industrial buying has been surprisingly steady and sales continue in good volume. A large order for electric vehicles was placed in that territory, and increased interest has been noted in industrial trucks. Business is better than expected in the New York district and industrial plants continue to buy steadily. An order was placed by one central-station company for two 15,000-kva. transformers. In the Southeast there are a good volume of diversified orders, a satisfactory demand for construction and transmission-line materials, and particularly from middle and south Georgia, where considerable expansion is under way, good buying of meters and transformers. Business has been maintained in satisfactory volume in the Middle West, and although there were no large orders, the aggregate sum of small orders is quite satisfactory. On the Pacific Coast conditions are good and the year's volume of business is reported as better than the previous year's.

Buying on Metal Market Not Heavy—Prices Firm

THE price of copper has held firm despite the easier tone in London, and producers show no disposition to shade prices. There has been no buying in large quantities, but good business is expected after the first of the year as consumption is good and buyers cannot remain long out of the market.

The American Smelting & Refining Company maintains its official contract price at 9¼ cents. The demand has

NEW YORK METAL MARKET PRICES

	Dec 23, 1925 Cents per Pound	Dec. 30, 1925 Cents per Pound
Copper, electrolytic	14½–14½	14½
Lead, Am. S. & R. price	9¼	9¼
Antimony	22	23¼
Nickel, ingot	34	34
Zinc, spot	8.85–8.95	8.90
Tin, Straits	62¾	62¾
Aluminum, 99 per cent	29	29

Base copper price Dec. 30, 1925, 16½ cents

slackened somewhat, although producers indicate that there is a large volume of business on their books. Consumption is good, but there is little interest in future commitments. The zinc market is quiet and there are few inquiries from consumers, but the price is firm. Tin prices are virtually unchanged, but there is little buying.

Business Maintained in Good Volume in the Middle West

BUSINESS has been well maintained in the Middle West. Several sizable orders for cable and some large sets of storage batteries were placed this week. Many utility companies are busy at this time with inventories and little large buying is being done, although the aggregate sum of the small orders placed is quite satisfactory. Orders for the past two weeks for stock are being scheduled for delivery after Jan. 1. The consensus of opinion among jobbers is that this week closed a very satisfactory year. There has been little activity other than the seasonal activity. Many jobbers are now taking inventory. While some jobbers are complaining that business is not up to previous standard, it is universally agreed that actual figures will show a good profit for the year. Building plans for 1926 appear quite comprehensive. In most cities of the Middle West good building programs have been laid out, while only in a few cases are the cities built up in excess of the demand. In Chicago a large building plan is expected.

Sales in the New England District Continue in Good Volume

THE trend of industrial equipment and supplies sales in the New England district has been surprisingly steady, and these sales are higher when compared with the records for the corresponding week over a period of previous years, says a prominent jobber. Small-motor sales for the past week declined and orders for central-station supplies have been gradually diminishing throughout the month. On the other hand, contractors' supplies, such as wire, conduit, wiring devices and hardware, have been moving steadily with little evidence of slackening.

Electric vehicle orders for a number of delivery trucks are reported by one company, and greater interest in industrial trucks was noted during December than at any other time during the present year, according to one manufacturer. Household electric appliance sales are the center of interest. In summing up the Christmas week one jobber reported an increase over the previous week amounting to more than $10,000.

Business Better than Expected in the New York District

SALES in the New York district can be summed up as better than expected. While there has been a slight lull owing to the holidays, there have been a considerable number of inquiries and steady buying by industrial plants continues. Central-station companies are also placing orders for general supply material, one order for underground cable and distribution material amounting to about $300,000. Another order covered two 15,000-kva. transformers and still another called for three 667-kva. units. There are also inquiries now out for several units of 2,000-kva. capacity each. Activity is noted among holding companies operating properties in Florida. A number of inquiries are out covering material required for a large amount of construction work planned for the spring and summer, and additional generating equipment has already been purchased.

The electric traction market is active. An order was placed by a transportation company for 333 gas-electric buses, another company is in the market for a number of cars, quite a little oil-engine locomotive work is pending, and indications point to a good year in 1926. The demand for wire, conduit and general building supplies has continued, report the jobbers, and despite the holidays the volume of buying is good. From present inquiries jobbers look for good purchasing to continue well into the new year.

Conditions Good on Pacific Coast —Two Large Orders Pending

THE past year has been an excellent one on the Pacific Coast, with a better volume of business than the previous year, though at a decreased profit rate. Prospects are even better for the new year. Contributing causes are the construction programs planned by power companies and railroads, building conditions, the opening of new suburban tracts for actual occupation—not speculation—and the improvement of such districts as those surrounding Fresno and Chico. Comparatively small stocks have been carried over. Recent power company inquiries have tapered off somewhat during the past fortnight and have included one carload of 35-ft. poles, 3,000 lb. assorted friction and weatherproof tape and 25,000 fuse plugs. Two big machinery jobs, for the Melones and Feather River plants are still unawarded.

Railroad purchasing is temporarily light, one carload of 25-ft. poles being about the only item reported above the repair or maintenance variety. Export business is very dull. Orders for wiring material have been small, scattering and urgent, except for rubber-covered wire, for which a number of 25,000-ft. stock orders are reported. The city of Seattle is in the market for 60,000 lb. of copper wire, and the Puget Sound Power & Light Company has requested quotations on two 250,000-circ.mil, three-conductor submarine cables, 23,000 ft. each.

Good Volume of Diversified Sales in the Southeast

BUYING is reported in excellent volume for all classes of material in the Southeast and prospects are for continued good business over into the new year. The retail electrical business has been unusually good and purchasers have taken a much better class of merchandise than heretofore. Jobbers' stocks of Christmas toys and specialties have been exhausted, and indications are that the retail dealers will have little or no carry-overs in these lines.

Along with the excellent holiday business is a most satisfactory volume of orders for construction and transmission-line materials, this business having held up well through the holidays this year. Central-station companies are buying meters and transformers in good volume, particularly in middle and south Georgia, where considerable expansion is under way. One jobber reports a very satisfactory order from a large central-station company for lightning arresters in anticipation of spring and summer requirements. Industrial motors up to 200 hp. are moving satisfactorily with business brisk in sizes up to 50 hp. Radio continues very active. With the exception of the Florida territory, the demand for ranges is somewhat quiet at this time, but in that state range and water-heater sales are excellent with no prospects of a slowing up in demand.

Activities of the Trade

Sale of Incandescent Lamps Shows 7 per Cent Increase

The sale of incandescent lamps such as are used in the lighting of homes reached the total of 280,000,000 in 1925, according to the annual review of the electrical industry by John Liston of the General Electric Company. This is an increase of 7¼ per cent over 1924 and is four and one-half times the figure for 1908. In addition, the sale of miniature lamps, such as are used in automobiles, flashlights, on Christmas trees, etc., reached the total of 195,000,000 an increase of about 3¾ per cent over 1924. "Although the average wattage of lamps has varied but slightly, the average lumens or candlepower has increased considerable," Mr. Liston points out. "The price of 'Mazda' lamps has been reduced materially in recent years, owing to improved methods in manufacture. The present prices of lamps are on the average less than two-thirds of those in effect in 1914, while the cost of living is now 50 per cent greater than the pre-war figure."

The most important development of the past year was the development of a practical method of frosting the inside surface of incandescent lamp bulbs. The fragility which formerly existed has been overcome by a chemical treatment. The initial aborption of light due to inside frosting is less than 2 per cent, whereas the outside frost absorbs

6 to 8 per cent. In the miniature-lamp field the most important achievement was the production of the double-filament "Mazda" headlight lamp containing two 21-cp. filaments.

Jeffery-Dewitt and Champion Plan Additions to Factory

The Jeffery-Dewitt Insulator Company, Kenova, W. Va., jointly with the Champion Switch Company, Buffalo, N. Y., announces the appointment of W. L. Stinson as vice-president and general sales manager of both companies. Mr. Stinson has been superintendent of the Champion Switch Company for the past two years and prior to that time was sales manager for the Insulator company. The general sales office will be in Buffalo.

The companies say that they have enjoyed a very satisfactory business during the year just closed. The foreign trade is said to have shown an especially pleasing increase, particularly in Australia, New Zealand and South America, and indications for 1926 point toward a capacity production for the Kenova factory. The board of directors recently declared the regular 7 per cent dividend on preferred stock, payable January 1, and specifications were also approved for the addition of a 300,000-volt transformer to the factory testing equipment to be installed early in 1926. Extensive additions to the factory are also planned.

Major Industry Activities in 1925

Entrance of a Foreign Manufacturer in the American Field and the Activity of the Refrigerator Companies Commanded Especial Interest

OF THE activities of the industry during 1925, the announcement of the entrance of the Brown, Boveri Company in the American field probably caused the most notice. From the standpoint of general interest, the various activities of the domestic refrigerator manufacturers, the announcement of low-priced models and the entrance of new manufacturers in this field have been prominent in the news and have attracted the attention not only of the industry but of the general public. Reports of constantly increasing sales, of enlarged manufacturing facilities and of company consolidations in the refrigerator field have been comparatively frequent.

Motor price reductions made early in the year created much comment for and against the action. These reductions were made at a time when the market was weak. Developments later in the year found that branch of the industry filling many orders, and all motor manufacturers have reported increased sales as compared with those in 1924, although many companies report that profits are not commensurate with the volume of business transacted. During the year several company consolidations were reported. These included one involving three wire companies, another involving two manufacturers of resistance materials, another including a boiler manufacturer and two manufacturers of combustion equipment. These consolidations all permitted the new corporations thus formed to offer a more complete line of equipment with better service or at lower cost.

Other items of interest were the announcement of many new industrial heating applications, including electric furnaces and the increased use of welding equipment. Two large manufacturers also reported an agreement with foreign companies to exchange patent rights. Increasing interest in the manufacture of high-tension cable resulted in the General Electric Company obtaining the Pirelli patents and in the Okonite company joining with the Callender company to form the Okonite-Callender Company.

Despite the general knowledge that the industry has a reasonable amount of factory space that is yet to be utilized, there was a fair amount of new construction reported. Strong evidence of belief in the continued growth of the industry was shown in the recent purchase of a 155-acre property in St. Louis by the General Electric Company for a future factory site and in the announcement that the Westinghouse Electric & Manufacturing Company would erect a factory also in St. Louis, for making street-lighting standards.

Pittsburgh Transformer Receives Orders for Self-Cooled Units

The Pittsburgh Transformer Company reports having received orders for five 15,000-kva. self-cooled polyphase transformers, three of these for the New York Edison Company and two for New York & Queens Electric Light & Power Company, both of New York City. These five transformers will, it is said, be the largest polyphase self-cooled transformers when completed, and, in addition, they are notable for the fact that all the radiators are permanently attached and the transformers will be filled with oil and shipped ready for operation.

Nathan Klein & Company, 208 Center Street, New York, dealer in new and used machinery, announces that after twenty-five years of service it is liquidating its entire stock at an auction sale to be held on January 13, 14 and 15, at 10 a.m. each day. The company states that it will open a large electrical repair shop.

The United Electric Company, Canton, Ohio, announces that its improved model No. 5 "Ohio" vacuum cleaner and also its new "Gem" cleaner are now available.

The Westinghouse Electric & Manufacturing Company has purchased property in Detroit for the erection of a new building to house its district office, warehouses and service stations. Plans for the new building are not definite, but it is expected that construction will be started in the first half of 1926. A floor space of 100,000 sq.ft. will be necessary, says the company, to take care of the present requirements of the Detroit branch.

The Post-Glover Electric Company, Cincinnati, jobber, is planning to join with a group of nearby General Electric distributors in January in forming a new corporation the object of which will be to provide a more effective form of organization and give better service to its customers. The company states that this will in no way affect the manufacturing of switch and panel boards, resistance grids and the fabrication of transite and ebony and that the personnel will remain the same.

The Commercial Truck Company, 300 Hunting Park Avenue, Philadelphia, announces that the Crown Laundry Company of Indianapolis has just placed an order for a fleet of "C-T" electric trucks.

The Hydraulic Press Manufacturing Company, Mount Gilead, Ohio, is now introducing the "Forgsteel" valve for high-pressure and high-temperature conditions.

The Westinghouse Electric & Manufacturing Company announces that it has now placed a new electric range on the market, known as the "Senior Cabinet," which is said to have an exceptionally large oven, 18 in. high, 15 in. wide and 17¼ in. deep, with a lining of vitreous enamel.

The Edison Electric Appliance Company, 5600 West Taylor Street, Chicago, announces that R. W. Turnbull has been appointed district sales manager of the Pacific Coast district, succeeding P. H. Booth. Mr. Booth will continue to be connected with the sales department of the company with headquarters at Los Angeles.

The Electric Supply & Equipment Company, 278 Broadway, Albany, N. Y., wholesale distributors, with branch offices at Elmira and Buffalo, will hold its fourteenth annual convention at the Ten Eyck Hotel, Albany, on Saturday, January 9. On the same day an electrical and radio show will be held for the public in the hotel.

The American Metallurgical Corporation, Boston, announces that its sales in 1925 have double those of the previous year, and for 1926 the company states that a similar ratio will be maintained. There is increased activity in the use of electrical furnaces, says the company, owing to the widening field of their application in industry. It is said that lead pots of large capacities and continuous type electric furnaces are in demand and are being widely utilized in the metal-working industries.

The Pittsburgh Transformer Company, Pittsburgh, announces the appointment of Warren M. Beaman as district sales representative for the State of Texas, with offices at 1503 Santa Fe Building, Dallas.

The Cutter Electrical & Manufacturing Company, Nineteenth and Hamilton Streets, Philadelphia, manufacturer of circuit breakers, has appointed the J. Leo Scanlon Company, Ellicott Square Building, Buffalo, as a sales representative.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

NEWPORT, R. I.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Jan. 5, for 3,000 bakelite plugs, with copper leading wires molded in place, for the local navy yard (Schedule 4789).

EAST HAMPTON, CONN.—Preparations are being made by the Central Connecticut Light & Power Company for the installation of a new turbine at its Leesville power station, to double the capacity of the plant and also an addition to the power station.

Middle Atlantic States

BROOKLYN, N. Y.—The American Refining Company, 117 Wall Street, New York, plans to build a power plant in connection with extension in its refinery on South Second Street, to cost about $400,000. The cost of the entire project is estimated at $2,000,000.

BUFFALO, N. Y.—The City Council has approved the installation of an electric police signal system in four precincts, to cost $397,000.

BUFFALO, N. Y.—Electric power equipment will be installed in connection with rebuilding the factory of the Buffalo Body Corporation, 824 Seneca Street, which was recently damaged by fire, causing a loss of about $150,000. A generating set, etc., it is understood, will be required.

TRENTON, N. J.—The budget for the coming year provides $188,650 for various improvements in the lighting of the streets and parks, the most important of which is the installation of street lighting systems in Hiltonia and Glen Afton. The lamps and posts will be installed by the Public Service Corporation. Extensions will be made to the underground system on East State, Clinton and Perry Streets.

FARREL, PA. — Plans for the proposed plant of the Mercer County Creamery Company, to cost about $50,000, include a power plant.

WILMINGTON, DEL. — Arrangements have been completed between the Wilmington & Philadelphia Traction Company and the Philadelphia Electric Company whereby the former will purchase power from the latter. The Philadelphia company is now erecting a high-tension line from Chester, Pa., to the Delaware state line. The remainder of line, from Claymont to Wilmington, will be built by the traction company.

EXMORE, VA.—A. E. Fitkin & Company, 165 Broadway, New York, who recently purchased the property of the Exmore Light & Power Company, contemplate an addition to the local steam-operated electric plant, to cost about $200,000 and also extensions to transmission lines.

WASHINGTON, D. C. — Bids will be received by the Chief of Air Service, United States Army, until Jan. 11, for 180,000 ft. single conductor cable, shielded (Circular CAS 64).

WASHINGTON, D. C. — Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, until Jan. 5, for electrical supplies, including telephone plugs, copper ribbon and switches, electric heaters, etc., for various navy yards (Schedule 4827). Also, until Jan. 12, for magnet wire for various yards (Schedule 4846).

North Central States

AKRON, OHIO. — Property owners on South Main Street, between Thorton Street and Cole Avenue, have petitioned the City Council for the installation of an ornamental lighting system in South Akron.

COLUMBUS, OHIO. — Public improvements, to cost about $647,000, during 1926, has been approved by the Public Service Committee of the City Council. Included among the items is the installation of an ornamental lighting system on Broad and High Streets to cost $150,000; the construction of two substations for the municipal electric system, and the installation of a new boiler in the municipal electric plant, to cost $197,000.

PORTSMOUTH, OHIO.—The Portsmouth Public Service Company plans to build a substation at Tenth and Ofner Streets, to cost about $100,000 and also extensions in its transmission lines.

CHICAGO, ILL.—Bids will be received by the Signal Corps Procurement District, United States Army, Chicago, until Jan. 6, for 2,000 switchboard lamps, and eleven sheets laminated bakelite (Circular 17); Also, until Jan. 7, for 5,000 receiver shells, 10,000 receiver caps, 25,000 transmitter mouthpieces, etc.

RACINE, WIS.—Arrangements have been completed by the Wisconsin Gas & Electric Company for the erection of a 6-mile rural line to carry out a new rural electric service program which will benefit the farmers in Racine and Kenosha Counties. The line will be extended from Husher through Caledonia Center to Highway 57 which will serve more than 100 farmers. Another line will be built southeast from Burlington to serve Brighton and Wheaton rural communities in Kenosha County.

WILMOT, WIS. — The Cary Electric & Milling Company has applied to the Illinois Commerce Commission for authority to construct an electric plant in and near Solon Mills, Ringwood, Channel Dale and Lower Twin Lakes.

KANSAS CITY, Mo.—The Mapes Consolidated Manufacturing Company, Griffith, Ind., will install electric power equipment in its proposed paper products plant at North Kansas City, to cost about $130,000.

WASHBURN, N. D.—Arrangements are being made by the Otter Tail Power Company, Fergus Falls, to build a steam-driven power plant in Washburn, to serve towns east of the Missouri River.

BEATRICE, NEB. — Extensions and improvements are contemplated to the municipal electric light plant.

Southern States

ELKIN, N. C.—Arrangements have been made by the Southern Power Company, Charlotte, with the Town Commissioners to purchase the municipal electric plant, subject to the approval of the voters. An election will be held on January 26 to vote on the proposal. If it is approved the company will erect a transmission to Elkin.

MEMPHIS, TENN.—Permission has been granted the Memphis Power & Light Company to erect a transmission line from Memphis to Arlington.

ST. STEPHENS, ALA.—Plans for the proposed local cement mill to be erected by the Santa Rosa Portland Cement Company, recently organized at a cost of about $800,000, include a power plant. The H. K. Ferguson Company, Euclid Avenue, Cleveland, Ohio, is engineer for the buildings.

HOT SPRINGS, ARK. — Bids will be received by the Quartermaster, United States Army, until Jan. 5, for a quantity of electrical supplies, including sockets, wire, lamp cord, bushings, couplings, etc. (Circular 4).

PHARR, TEX.—Steps have been taken by the Boosters Club to secure an improved street lighting system.

Pacific and Mountain States

BREMERTON, WASH. — The Puget Sound Power & Light Company, Seattle, plans extensions in the local power plant of the North Pacific Public Service Company, recently acquired.

BAKERSFIELD, CAL.—The San Joaquin Light & Power Corporation, Fresno, has approved an appropriation of $1,000,000, for system extensions in Kern County.

LOS ANGELES, CAL.—Plans are being prepared by the Bureau of Power and Light for the erection of substations, at 3006 Trinity Street, 604 North Commonwealth Avenue, and 3520 South Normandie Avenue, respectively, to cost about $325,000.

RIVERSIDE, CAL. — The Southern Sierras Power Company has applied to the Federal Power Commission for a license to erect 8 miles of transmission line in Riverside County.

SACRAMENTO, CAL.—The Pacific Gas & Electric Company, San Francisco, plans extensions in its substation at Sixth and H Streets, including the installation of transformers, etc., to cost about $200,000.

MORRISON, COL.—The Jefferson County Power & Light Company, Golden, has applied to the City Council for permission to supply electric service in Morrison.

New Trade Literature

WALL CHART.—A wall sheet containing tables most frequently used in both electrical and machine shops has been prepared by the Mitchell-Rand Manufacturing Company, 18 Vesey Street, New York City. Among the tables included are tap drill sizes, inch equivalents, copper-wire working table, allowable carrying capacities of copper wire and cable, common insulating materials, etc.

STEAM-TESTING LABORATORY. — A booklet has been issued by Manning, Maxwell & Moore, Inc., 100 East Forty-second Street, New York City, describing the high-pressure steam-testing laboratory at its Bridgeport (Conn.) works. It contains a description of the first large 1,200-lb. boiler built in this country, which was installed at the Consolidated Safety Valve Works in Bridgeport. The object of this installation is primarily to actually test the safety valves manufactured for the high-pressure power plants now being built in this country. Illustrations are given showing the arrangement of the plant, equipment and accessories.

AUXILIARY DRIVE FOR POWER PLANTS.—"Electrical Drives for Power-Plant Auxiliaries" is the title of motor application circular No. 7,381, issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., in which it calls attention to the advantages of electric drive for power-plant auxiliaries, including pumps, fans and blowers, coal-handling equipment, pulverized-fuel equipment, etc.

MECHANICAL DRIVE TURBINE.—Bulletin GEA-197 issued by the General Electric Company, Schenectady, N. Y., covers its type "D-54" mechanical-drive turbine intended for the driving of centrifugal pumps, blowers, etc. A sectional view of the turbine as well as a complete description is included.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase and agency is desired in Johannesburg, South Africa (No. 18,408), for carbon brushes.

Purchase or agency is desired in Leipzig, Germany (No. 18,320), for electric abattoir machinery, coffee mills, jewelers' machinery, battery chargers, dishwashing machines, hair-cutting machines and electricaliy heated blankets; radio sets and parts (No. 18,311).

Purchase is desired in Lyons, France (No. 18300), of small alternating current and direct-current generators and small motors and electric or gasoline compressors.

An agency is desired in Auckland, New Zealand (No. 18,345), for electric household devices.

An agency is desired in Rio de Janeiro, Brazil (No. 18,363), for electric household devices.

An agency is desired in London, England No. 18,384), for electric household devices.

An agency is desired in Guelph, Canada (No. 18,405), for electric household devices.

Purchase is desired in Chihuahua, Mexico (No. 18,430), of instruments and apparatus, such as violet-ray and X-ray instruments for surgeons and physicians.

Purchase is desired in Montevideo, Uruguay (No. 18,429), of 317,000 insulators, insulator belts, switches, etc.; also of 24,040 meters and parts (No. 18,406).

An agency is desired in Weltevreden, Java (No. 18,404), for small waterwheel self-contained lighting sets.

Purchase and agency is desired in Birmingham, England (No. 18,318), for radio sets and parts.

Purchase is desired in Berlin, Germany (No. 18,319), of radio sets and parts.

An agency is desired in Lille, France (No. 18,321), for radio sets and parts.

Purchase is desired in Breslau, Germany (No. 18,428), of radio sets and parts.

An agency is desired in Guelph, Canada (No. 18,405), for wiring supplies and fixtures.

An agency is desired in The Hague, Netherlands (No. 18,359), for refrigerating machinery for cold-storage houses and ice plants.

Directory of Electrical Associations

Printed in the First Issue of Each Volume

AMERICAN ASSOCIATION OF ENGINEERS. Acting secretary, M. E. McIver, 63 East Adams St., Chicago, Ill.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Managing director, Lucius S. Storrs. Executive secretary, J. W. Welsh, 292 Madison Ave., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Colin G. Fink, Columbia University, New York City.

AMERICAN ENGINEERING COUNCIL. Executive secretary, L. W. Wallace, 26 Jackson Place, Washington, D. C.

AMERICAN ENGINEERING STANDARDS COMMITTEE. Secretary, P. G. Agnew, 29 West 39th St., New York City.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, P. W. Henry, 111 Broadway, New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. National secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets bi-monthly. Sections and branches meet monthly in the principal electrical centers throughout the country. Three national and several regional conventions held each year.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS. Secretary, H. Foster Bain, 29 West 39th St., New York.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

AMERICAN WELDING SOCIETY. Secretary, M. M. Kelly, 29 West 39th St., New York.

ARKANSAS UTILITIES ASSOCIATION. Secretary, R. I. Brown, Arkansas Central Power Co., Little Rock, Ark.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, Frederic Nicholas, 30 East 42d St., New York City.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Preston S. Millar. 80th St. and East End Ave., New York.

ASSOCIATION OF ELECTRAGISTS INTERNATIONAL (formerly National Association of Electrical Contractors and Dealers). Secretary, Laurence W. Davis, 15 West 37th St., New York City, N. Y. Direct membership throughout the United States and Canada.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Business manager, John F. Kelly, Empire Building, Pittsburgh, Pa.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Room 413, C. & N. W. Terminal Station, Chicago, Ill.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary, Louis Kon, 311 Power Bldg., Montreal.

COLORADO PUBLIC SERVICE ASSOCIATION. Secretary-treasurer, O. A. Weller, Public Service Co. of Colorado, Denver, Col.

EAST CENTRAL GEOGRAPHIC DIVISION, N. E. L. A. Secretary, D. L. Gaskill, Greenville, Ohio.

EASTERN GEOGRAPHIC DIVISION, N. E. L. A. Secretary, Harold A. Buch, 212 Locust St., Harrisburg, Pa.

ELECTRIC CLUB OF CHICAGO. 30 North Dearborn St., Chicago, Ill.

ELECTRIC POWER CLUB. Executive secretary, S. N. Clarkson, B. F. Keith Bldg., Cleveland, Ohio.

ELECTRICAL LEAGUE OF COLORADO. Executive manager, S. W. Bishop, Gas and Electric Bldg., Denver, Col.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, Walter F. Field, Safety Cable Co., New York City.

ELECTRICAL MANUFACTURERS' COUNCIL. Executive secretary, Frederic Nicholas, 30 East 42d St., New York City.

ELECTRICAL SAFETY CONFERENCE. Secretary, R. B. Shepard, 109 Leonard St., New York City.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, ATLANTIC DIVISION. Secretary, E. Donald Tolles, 165 Broadway, New York City.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, PACIFIC COAST DIVISION. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, Grand Central Terminal, New York City.

FLORIDA ENGINEERING SOCIETY. Secretary, P. L. Reed, Gainesville, Fla.

GEORGIA ELECTRICAL ASSOCIATION. Secretary-treasurer, W. W. Barr, Georgia Railway & Power Co., Atlanta, Ga.

GREAT LAKES GEOGRAPHIC DIVISION, N. E. L. A. Secretary-treasurer, R. V. Prather, 205 Illinois Mine Workers' Bldg., Springfield, Ill.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary-treasurer, R. V. Prather, 205 Illinois Mine Workers' Bldg., Springfield, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, L. H. Graves, 31 West 46th St., New York City. Sections in New York, Detroit, Philadelphia, Chicago and Boston. Chapters in San Francisco, Cleveland, Columbus, Detroit, Los Angeles, Newark, N. J., Pittsburgh, Providence and Toronto.

ILLUMINATING GLASSWARE GUILD. Asst. business manager, C. H. Ferris, Stevenson Corp., 19 West 44th St., New York City.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donohue, Lafayette, Ind.

INSTITUTE OF RADIO ENGINEERS. Secretary, Alfred N. Goldsmith, 37 West 39th St., New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, Erwin H. Benz, West New York, N. J.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA SECTION, N. E. L. A. Secretary and treasurer, H. E. Weeks, Davenport, Iowa.

KANSAS SECTION, N. E. L. A. Secretary, H. Lee Jones, 820 Kansas Ave., Topeka, Kan.

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MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, 315 North 12th St., St. Louis, Mo.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Executive secretary, T. H. Day, 59 Deerfield Ave., Hartford, Conn.

NATIONAL ASSOCIATION OF LIGHTING EQUIPMENT DEALERS. Secretary, R. W. Smith, Room 330, 522 Fifth Ave., New York, N. Y.

NATIONAL ASSOCIATION OF RAILROAD AND UTILITIES COMMISSIONERS. Secretary, James B. Walker, 270 Madison Ave., New York City.

NATIONAL COUNCIL LIGHTING FIXTURE MANUFACTURERS. Secretary, H. B. Garrett, 424 Guarantee Title Bldg., Cleveland, Ohio.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Managing director, M. H. Aylesworth, 29 West 39th St., New York City.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1008 Marquette Building, Chicago, Ill. Central, New England, New York, Middle and Southern Atlantic States, and Pacific Coast Divisions.

NATIONAL FIRE PROTECTION ASSOCIATION. Chairman of electrical committee, A. R. Small, 109 Leonard St., New York City.

NATIONAL SAFETY COUNCIL. Managing director and secretary, W. H. Cameron, 108 East Ohio St., Chicago, Ill.

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NEW YORK ELECTRICAL SOCIETY. Secretary, H. E. Farrer, 29 West 39th St., New York City.

NORTH CENTRAL ELECTRIC ASSOCIATION (Geographic Division N. E. L. A.). Executive secretary, J. W. Lapham, 351 Loeb Arcade, Minneapolis.

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OKLAHOMA UTILITIES ASSOCIATION. Manager, E. F. McKay, 307 Local Building, Oklahoma City.

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WISCONSIN UTILITIES ASSOCIATION. Executive secretary, John N. Cadby 445 Washington Bldg., Madison, Wis.

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Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

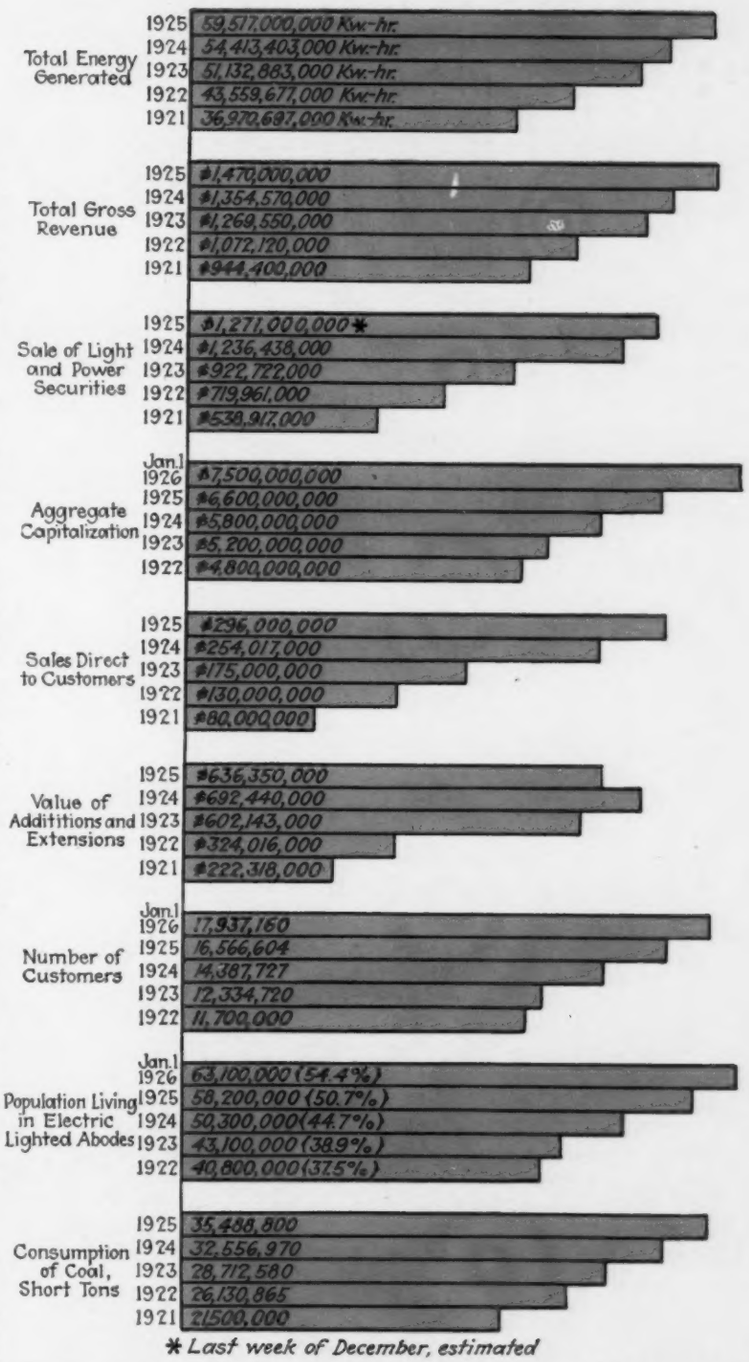
The Past

The best prophet of the future is the past.—BYRON.

THE only legitimate excuse for looking backward over the activities of an industry is that from these past performances a trend or trends may be established which will show the way into the future. We may analyze the past, but it is the future which is vital. But the activities of the future must depend upon the foundation and superstructure which have been laid and constructed in the past.

The first six years of the present decade have witnessed a phenomenal growth in the activities of the electric light and power industry. The industry emerged from the war period an essential element in the social, civic and industrial life of the nation. America had drawn into her being a life-giving fluid which had made war efficiency and economy a permanent condition in the industrial and home life of the country. The resulting demand for more and more of this heretofore unappreciated servant of mankind was followed during the six-year period, 1920-1925, by an increase of 25,000,000,000 kw.-hr. in energy generated per annum, an increase in the nation's annual electric bill of $700,000,000, an increase of 8,000,000 customers served from central-station lines, and a growth in the number of people living in electrically lighted abodes of from 34,700,000, or 32.8 per cent of the population, on Jan. 1, 1920, to 63,100,000, or 54.4 per cent of the population, on Jan. 1, 1926. During this period a total of over $5,000,000,000 was loaned by the American people to the central-station companies of the country for expansion purposes, and the sales of securities direct to customers were increased from $43,000,000 in 1920 to $296,000,000 in 1925. During the six-year period the trend toward centralized management has become more and more pronounced, culminating in 1925 with the absorption of 407 operating and administrating companies with an aggregate capitalization of $1,957,263,000. Truly a marvelous story of progress!

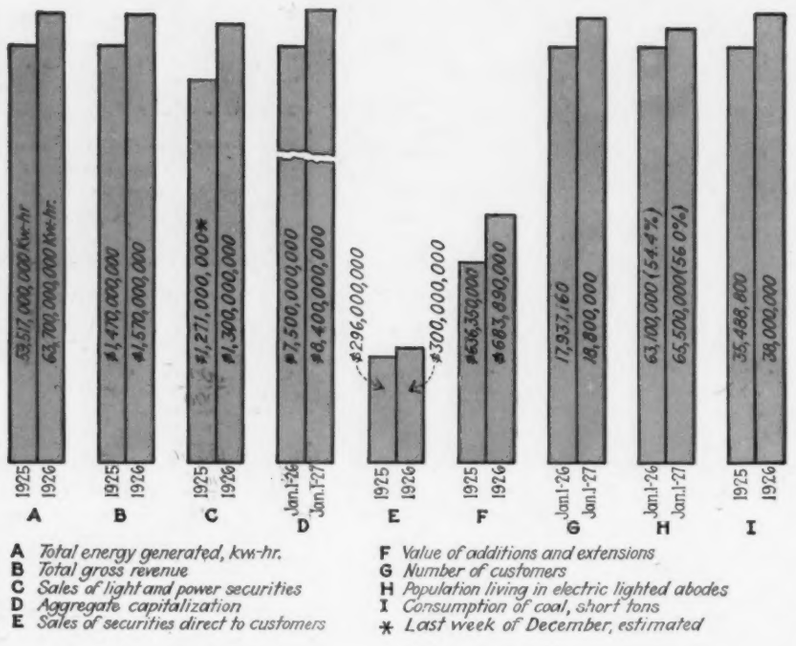
Taking the country as a whole, the past year has shown a continuation of these trends except in one instance. During the past year the number of new customers added to the lines totaled 1,374,956 as against 2,178,877 in 1924, thereby calling to the attention of the industry the fact that a new milestone in its development had been reached and that its future growth must be along new lines. As indicated above, 54.4 per cent of the people of the nation are now living in electrically lighted dwellings, while the latest census shows only 51.4 per cent of the population living in cities and towns of over 2,500 population. There are now 622,950 industrial power customers and 65 per cent of the industrial power of the country is now electrified. The housing shortage is largely over, and in some cities there is even talk of a slight surplus in domestic and commercial structures. All these facts point unmistakably to a continued drop in the number of customers added to the lines in subsequent years until the annual increase in number of customers balances with the normal annual increase in population and industry.



* *Last week of December, estimated*

The Future

So often do the spirits
Of great events stride on before the events,
And in today already walks tomorrow.
—COLERIDGE.



A *Total energy generated, kw-hr.*
B *Total gross revenue*
C *Sales of light and power securities*
D *Aggregate capitalization*
E *Sales of securities direct to customers*
F *Value of additions and extensions*
G *Number of customers*
H *Population living in electric lighted abodes*
I *Consumption of coal, short tons*
* *Last week of December, estimated*

THE question uppermost in the mind of all industry at just this time is, "What of 1926?" The year just closed has been a good year, a record year in many ways. What will the industrial activities of 1926 look like compared with those of 1925? To what extent will the trends established during 1925 and in previous years influence the operations of 1926? The exact answer to these questions is, of course, beyond human ken; but the trends established or maintained during the past year can be extended into the future, and some idea can be gained thereby of what the activities of the industry will probably be during the next twelve months.

That 1926 will be another record year for the electric light and power industry is unquestionable. The industry has reached a point in its development, however, where the annual growth in certain items may not reach that established in former years. But the end of 1926 will find the industry on a considerably higher plane than ever before. The energy generated should increase from 59,517,000,000 kw.-hr. in 1925 to 63,700,000,000 kw.-hr., the gross revenue from $1,470,000,000 to $1,570,000,000, the new financing for the year from $1,271,000,000 to $1,300,000,000, and the amount spent for additions and extensions to the generating and transmission equipment should increase from $636,350,000 to $683,890,000, with an added $50,460,000 for administrative quarters, warehouses, etc. Between 900,000 and 1,000,000 new customers should be added to the central-station lines during the year, and the installed generator rating should be increased by 1,500,000 kva.

Among the many trends established or maintained in the past year, four appear as most indicative of what may be expected of 1926. There appears to be no doubt that the number of new customers taken on the lines during the next twelve months will be under that recorded in any year since the war. The reasons for this are discussed elsewhere in this issue, the basic factor being that growth in this direction is becoming narrower each year and that future growth in number of customers must conform more and more closely to the normal growth in population and industry.

The new generator rating added during 1926 should be materially under that during 1924 and 1925. During these two years a total of 5,260,000 kva. was added to the generator equipment of the nation. A large majority of the companies reported that the equipment added during the past two years will carry the expected load to be added during 1926. The central-station expenditures during the year for extensions to the transmission and distribution systems should greatly exceed the expenditures for generating equipment.

It is hardly to be expected that the trend toward centralization of management will reach the proportions recorded during 1925, when the capitalization of the operating and administrative companies absorbed totaled very nearly $2,000,000,000. Merging of properties will, of course, continue in large volume, but in reduced proportions.

In anticipation the year 1926 might be termed a year of great progress and also a year of new tendencies and trends. It should prove one of the most interesting years of the electric light and power industry historically.

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote for use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.